TITLE: The effects of a rowing machine exercise program on aerobic capacity, gait speed and posture in people living with Parkinson's disease

AUTHORS/INSTITUTIONS: S. O'Neal, M. Eikenberry, Physical Therapy, Midwestern University, Phoenix, Arizona, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Parkinson's disease (PD) is a progressive, neurodegenerative disorder characterized by bradykinesia, tremors, rigidity and postural instability. Consequently, people with PD (PWP) experience a decline of mobility and worsening posture which can promote a more sedentary lifestyle, therefore negatively impacting aerobic capacity. An indoor rowing machine has been proven effective to improve aerobic fitness in the healthy population. It has been established that intensive exercise has beneficial effects with PWP. There is no known literature on the effects of the use of an indoor rowing machine with people with PD. The primary aim of this study was to assess the effectiveness of an indoor rowing machine on aerobic fitness in PWP. Secondary aims were to assess any changes in balance, gait speed and posture.

Case Description: A pre-test, post-test design was utilized for this study. Five community-dwelling adults with PD in Hoehn and Yahr stages 2-3 completed a rowing program 2x/week for 6 weeks. Primary outcome measure was the 6 Minute Walk Test (6MWT) with secondary measures including the 10 Meter Walk Test (10MWT), Mini-BESTest and a postural analysis utilizing the PostureScreen Mobile iPad application (PostureCo Inc., Trinity, FL, USA). Each session included a 5 minute warm up, 20 minutes of rowing and 5-minute cool down. Each participant wore a heart rate (HR) monitor chest strap, with HR being displayed on the rower screen. Moderate intensity HR range was calculated for each person using age-predicted maximal HR and displayed on the rower. A rate of perceived exertion scale was also utilized to ensure exercise in the moderate intensity level.

Outcomes: Three participants demonstrated positive change with the 6MWT, one reaching clinically significant change (384.7 m to 508.4 m; minimal detectable change (MDC): +82 m). Four participants demonstrated positive improvements with comfortable gait speed, with two reaching clinically significant change (MDC: +0.18 m/s). Mini-BESTest changes were variable, however no changes were beyond the MDC (5.52 points). Positive postural changes were noted, with three participants demonstrating less forward head deviation in standing and two participants demonstrating less knee flexion in standing.

Discussion: Positive trends were noted in aerobic capacity and gait speed, with some participants demonstrating clinically significant change. There were positive results in posture, which may be related to the nature of the rowing exercise and its focus on extensor musculature. Qualitative data taken at the end of the study revealed the participants enjoyed the rowing machine and felt positive effects. The addition of a rowing program may be beneficial to community-dwelling individuals with PD to improve exercise compliance, aerobic capacity, gait speed and posture. More research is needed to assess effects of a longer duration program as well as compare short, higher intensity intervals versus longer, moderate intensity sessions.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

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Burst Mode Alternating Electrical Current in the Management of Parsonage-Turner Syndrome: A Case Report

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Background & Purpose: Parsonage-Turner Syndrome (PTS) is a rare, often idiopathic brachial plexus nerve disorder characterized by sudden onset of acute shoulder pain, upper extremity paresis, and atrophy. Controversy exists regarding the appropriate type, timing, and feasibility of electrical stimulation to promote the recovery of strength and lost function. The purpose of this report is to describe the use and outcomes of Burst Mode Alternating Current (BMAC) as an adjunct to traditional physical therapy in a patient with PTS.

Case Description: A 45-year-old male with PTS was examined two months following initial onset of symptoms and presented with limited and painful active and passive left shoulder range of motion (ROM), decreased shoulder strength (2-/5 to 4/5), and associated muscle atrophy. He was unable to perform his work duties as a pipefitter and scored 89/130 (68% disability) on the Shoulder Pain and Disability Index (SPADI). To facilitate recovery and reverse atrophy, BMAC at 2500Hz, bursting at 50Hz, was applied to the left deltoids, supraspinatus, and infraspinatus muscles during active strengthening activities 2 days per week for 7 weeks. ROM and manual therapies were also utilized to address adaptive shortening and joint hypomobility.

Outcomes: By 15 weeks post onset, the patient demonstrated a 49% reduction in disability, as measured by the SPADI (25/130), improved muscle strength (≥4/5), and a reduction in pain, thus allowing him to return to work at full duty.

Discussion: This case report describes the near full recovery of strength and function following physical therapy with BMAC in a patient with PTS. BMAC applied during the subacute stage of recovery is feasible and it may hasten the return of strength and functional abilities. Further research to determine the optimal timing and dose is warranted.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: Benefits of Physical Activity in Improving Function in persons with Parkinson Disease

AUTHORS/INSTITUTIONS: A.A. Andreasik, A.A. Williams, C. Colon-Semenza, T.R. DeAngelis, K. Hendron, T. Ellis, Center for Neurorehabilitation, Boston University, Boston, Massachusetts, UNITED STATES

ABSTRACT BODY:

**Purpose/Hypothesis:** Retrospective studies in Parkinson disease (PD) reveal that self-reported physical activity (PA) levels that exceed 150 minutes per week are associated with improved function and better quality of life.\(^1\) However, numerous studies suggest that PA levels are substantially reduced in individuals with PD compared to healthy older adults.\(^2\) In fact, a 12% decline in average daily steps over the course of 1 year has been reported in PD despite no significant decline in disease severity.\(^3,4\) Few studies have prospectively examined the relationship between increasing PA and changes in physical function in PD. Therefore, the purpose of this study was to determine if increasing PA over 1-year improved physical function in persons with PD.

**Number of Subjects:** 44 individuals with mild to moderate PD (stage Hoehn & Yahr 1-3)

**Materials/Methods:** Participants completed a 1-year home exercise program consisting of progressive resistance exercises and walking with features to facilitate behavioral change. Subject characteristics, including self-efficacy, were measured at baseline. PA in the form of daily steps was measured for 7 days at baseline and at 12 months utilizing a step activity monitor (SAM). Participants were dichotomized into a high PA (HPA) group and low PA (LPA) group at 12 months: those who increased PA > 800 steps per day (threshold for clinically meaningful change) from baseline to 12 months were designated as the HPA group; whereas those who experienced a reduction in PA or an increase that did not exceed the MCID were designated as the LPA group.\(^5\) Measures of physical function were administered at baseline and 12 months and included the six minute walk test (6MWT), gait speed, the Brief BESTest and the Functional Gait Assessment (FGA). Independent T tests were performed to examine differences in the physical function measures over 1-year between the HPA and LPA groups.

**Results:** There was no significant difference in baseline characteristics between groups, with the exception of self-efficacy which was higher in HPA group. Of the 44 participants, 17 increased their daily steps by greater than 800 steps per day. There was a significant difference in 6MWT distance and gait speed between groups (p=<.05). In the 6MWT, the HPA group demonstrated an improvement of 64m compared to the LPA group which decreased by 8m. The HPA group increased gait speed by 0.18m/s compared to the LPA which decreased by 0.02m/s. The change in Brief BESTest (HPA=1.76, LPA=.67; p=.059) and FGA (HPA=2.71, LPA= .44 points; p=.067) scores between groups approached significance.

**Conclusions:** An increase in PA leads to improved physical function and reduced disability in persons with PD. In addition, individuals with higher exercise self-efficacy at baseline are more likely to increase PA.

**Clinical Relevance:** Increasing PA in persons with PD improves physical function. Physical therapists play a critical role in emphasizing and fostering increased PA as part of the treatment of persons with PD.
Combination of Visual Scanning Training and Limb Activation to Improve Left Visuospatial Neglect Following Acute Stroke: A Case Report.

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Background & Purpose: Stroke is a common condition that can result in a variety of cognitive and/or functional deficits. Visuospatial neglect occurs in up to 43% of right hemispheric strokes. Current research is limited on the effectiveness of a combination of intervention strategies for visuospatial neglect. The purpose of this case report was to describe the outcomes of a patient with left visuospatial neglect following acute stroke, who was treated with visual scanning training and limb activation in conjunction with standard physical therapy.

Case Description: A 52-year-old female patient developed sudden onset left-sided weakness, right-side gaze preference, and slurred speech five days following her first round of chemotherapy treatment for ovarian cancer. Two weeks post ischemic right MCA stroke, the patient presented to inpatient rehabilitation. Upon examination, FIM scores indicated functional disability, requiring minimum assistance for transfers and ambulation. Visuospatial neglect assessments (Cancel 2 Test, House Drawing Test, and Clock Drawing Test) required moderate verbal cues and demonstrated decreased awareness of the left side.

Outcomes: The patient's length of stay was 13 days and she received treatment three hours per day, five days per week. Interventions included visual scanning training and limb activation in addition to standard physical therapy (gait training, transfers, bed mobility, and strengthening exercises). FIM scores upon discharge indicated modified independence with all functional mobility tasks, including transfers, ambulation, and stairs. All three visuospatial neglect assessments were completed with 100% accuracy and no cueing required.

Discussion: Combination of visual scanning training and limb activation in addition to standard physical therapy treatment may be beneficial to improve left visuospatial neglect in patients post-stroke in the inpatient rehabilitation setting. Further research is needed to determine optimal dosage and if combination of intervention strategies is better than standard physical therapy alone on improving visuospatial neglect, as well as the long-term effects.


Early Aggressive Mobilization following Locked-In Syndrome from Central Pontine Myelinolysis: A Case Study

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ABSTRACT BODY:

Background & Purpose: Central Pontine Myelinolysis (CPM) is an osmolar demyelinating condition that most frequently develops following the rapid correction of an acute hyponatremic episode. Locked-In Syndrome (LIS) is one of the most severe clinical manifestations in patients with CPM and is associated with a high mortality rate, as up to 90% of individuals die within 6 months of onset. For survivors, therapy services are often limited and are compensatory in nature, focused on providing caregiver education for long-term management and prevention of secondary medical complications. Without recovery-based intervention, individuals remain dependent for all self-care and mobility needs, and are often admitted to long-term care facilities due to the immense caregiver burden. Current literature supports the use of early, aggressive mobilization for motor recovery in various neurologic populations, including incomplete spinal cord injury and stroke. However, limited studies investigate the effect of early neurorehabilitation on recovery from LIS of osmolar etiology. Therefore, the purpose of this case study is to investigate the effect of an early, aggressive mobilization protocol on neurologic adaptation and facilitation of motor return in an individual with LIS following CPM.

Case Description: The individual is a 45-year-old male with chronic alcoholism who developed incomplete LIS from CPM following an episode of hyponatremic encephalopathy. The intervention included six-weeks (60 min/day; 5 days/week) of aggressive, recovery-based mobilization in an inpatient rehabilitation hospital. Therapeutic intervention consisted of body-weight assisted locomotor treadmill training, functional electrical stimulation (FES), and progressive resistance exercise (PRE). Functional progress was monitored using the Trunk Impairment Scale (TIS), Braden Risk Assessment Score, and Functional Independence Measure (FIM).

Outcomes: At the conclusion of the six weeks, the patient demonstrated full anti-gravity movement in all extremities and returned to functional household ambulation with minimal assistance from a single caregiver. TIS score improved from 0/23 to 15/23 at final assessment. At discharge he scored a 17/23 on the Braden Risk Assessment Score, indicating minimal risk for the development of pressure ulcers in the inpatient rehabilitation setting. Functionally, the patient safely discharged home with his spouse and continued outpatient therapy.

Discussion: This study illustrates the benefits of early, aggressive mobilization for motor recovery in individuals with LIS from osmolar etiology and outcomes suggest that these early, aggressive interventions are critical in facilitating return to functional ambulation and independence for individuals with CPM. Aggressive mobilization is not only safe and feasible for this population, but may effectively alter discharge disposition and prognosis for functional recovery.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Functional Measurement Post-Stroke via Mobile Technology

AUTHORS/INSTITUTIONS: H. True, N. Fell, Physical Therapy, University of Tennessee at Chattanooga, Chattanooga, Tennessee, UNITED STATES| A. Harris, J. Cho, Z. Hu, M. Sartipi, Computer Science, University of Tennessee at Chattanooga, Chattanooga, Tennessee, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Stroke is a leading cause of long-term disability in the United States, directly impacting more than 795,000 individuals each year. While stroke prevalence is expected to increase in coming years, average hospital length of stay post-stroke has declined 47% from 1989 to 2009. Mobile health technology may be leveraged to extend personalized medical and rehabilitation management beyond the acute stroke phase. This study examined the correlations between clinician and mobile application measures collected with body-worn sensors for 4 common clinical tools: Functional Reach Test (FRT), NIH Stroke Scale (NIHSS) Motor Arm and Motor Leg items, and gait speed derived from the 10 Meter Walk Test (10MWT).

Number of Subjects: 35 subjects post acute stroke, 21 males and 14 females at an in-patient rehabilitation hospital, participated in the study. IRB approval #14023.

Materials/Methods: Led by a physical therapist, subjects performed the FRT, NIHSS Motor Arm, NIHSS Motor Leg, and 10MWT three times each while wearing body-worn sensors (FRT: 1 worn at the sternum; NIHSS motor arm and leg: 1 worn at mid-humerus and ankle, respectively; 10MWT: 2 worn at ankles). Each sensor is an inertial motion unit (IMU) containing 3-axis accelerometer, magnetometer, and gyroscope. Motion data were transferred wirelessly from the sensor(s) to an iPad for computer application analysis. Simultaneously, the therapist assessed and scored each activity. Correlation coefficients between clinician and mobile application measures were calculated for each activity using SPSS version 23.

Results: Significant positive correlations (p<0.001) were observed between clinician and mobile application measures: FRT (r= 0.630); NIHSS Motor Arm (r=0.839); NIHSS Motor Leg (r=0.736); and 10MWT (r=0.994).

Conclusions: These findings support further development and testing of mobile health systems to facilitate improved quality and efficiency of post-stroke management.

Clinical Relevance: Mobile health technology has the potential to improve the quality and efficiency of care by providing remote monitoring, adherence support, ongoing treatment, and communication links between patients and their healthcare providers. This study provides insight into the feasibility of remote assessment via mobile application measures and serves as a foundation for further development and more advanced implementation of a comprehensive mobile health system. Additionally, information gathered through mobile health applications may ultimately contribute to longitudinal analyses regarding recovery and recurrence post-stroke.
Increasing Access to Cost Effective Home-Based Robotic Telerehabilitation for Stroke Survivors

A. Butler, S.N. Housley, A. Garlow, T. Thomas, K. Ducote, A.L. Howard, D. Wu, K.M. Richards, Department of Physical Therapy, Georgia State University, Atlanta, Georgia, UNITED STATES

Purpose/Hypothesis: Stroke is a leading cause of long-term disability with an estimated 795,000 incidences in the United States annually. Unfortunately, access to stroke rehabilitation services for rural patients is limited which can reduce functional recovery and quality of life. The aim of this study was to analyze the implementation of Home-Based Robot Telerehabilitation (HBRT) on functional outcomes and quality of life, access, utilization, cost, and participant satisfaction in stroke survivors.

Number of Subjects: 20 rural veteran stroke survivors with upper extremity/lower extremity hemiparesis that occurred within the last 24 months were included in the study.

Materials/Methods: An HBRT Foot or Hand Mentor was deployed to Veteran stroke survivors with upper or lower extremity motor impairments for three months, while a physical therapist remotely monitored progress. Outcome measurements recorded were: FIM and the Center for Epidemiological Studies Depression Scale (CES-D) for all participants, the Action Research Arm Test (ARAT) for UE participants, and the 10 meter walk test (10MWT) and 6 minute walk test (6MWT) for LE participants. Baseline and follow-up outcome measures of function and quality of life were analyzed. Daily usage was recorded and utilization was analyzed. The cost analysis of HBRT compared to clinic-based therapy was based on the device cost as well as VA statistics of the salary of therapists and average cost of transit. Participant satisfaction was assessed through an exit survey. Mean and percent change scores were calculated with 95% confidence intervals. Paired t-tests were performed for all the outcome measures.

Results: Compared to baseline, significant improvement in upper extremity function (30.06%, p=0.046), clinically significant benefits in gait speed (29.03%), moderate improvement in depressive symptoms (28.44%) and modest improvement in distance walked (30.2%) were observed. Participants indicated satisfaction with the device. HBRT expanded access to post-stroke rehabilitation for 35% of the people no longer receiving formal services and increased daily access for the remaining 65%, with a potential to save $2,352 (64.97%) over the three months compared to clinic-based therapy.

Conclusions: HBRT can elicit meaningful improvements in UE function, gait speed, walking distance and quality of life for stroke survivors. Statistically significant improvements in UE motor function corroborate the findings of others. HBRT has the potential to reduce therapy cost and expand access for rural stroke survivors.

Clinical Relevance: HBRT provides reliable, reproducible treatment while measuring performance without the need for real-time therapist oversight. For rural stroke survivors, who are less likely than their urban counterparts to receive rehabilitation post-stroke, HBRT has the potential to provide cost-effective, high-quality treatment to help them regain the functional capacities required to perform activities of daily living and ambulation post-stroke.
Title: Effectiveness of Vestibular Rehabilitation on Concussion-Induced Vertigo: A Systematic Review

Authors/Institutions: B. Kinne, J. Bott, N. Cron, R. Iaquaniello, Grand Valley State University, Grand Rapids, Michigan, United States

Abstract Body:
Purpose/Hypothesis: Dizziness is one of the most common symptoms that causes individuals to seek health care services. Although vestibular rehabilitation was originally designed to treat individuals with vestibular dysfunctions, several non-vestibular issues have also been treated with this type of therapy. One medical condition that may not stem from a vestibular origin is a concussion. The purpose of this systematic review was to investigate the effectiveness of vestibular rehabilitation on concussion-induced vertigo.

Number of Subjects: N/A

Materials/Methods: Those databases that were utilized for search terms included CINAHL Complete, Proquest Medical Library, and Pubmed. The search terms were "concussion" OR "brain injury" OR "head injury" AND "vestibular rehabilitation" OR "vestibular therapy" AND "vertigo". The inclusion criteria encompassed the following: (1) individuals with vertigo induced by a concussion, (2) an intervention group that received vestibular rehabilitation, and (3) outcome measures that assessed vertigo. The Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence system was used to assess the evidence level of each included study. Methodological rigor was assessed utilizing criteria set forth in a systematic review by Medlicott and Harris.

Results: Nine hundred twenty-nine articles were identified through an electronic database search, and two additional articles were identified through other sources. Five articles were included in the qualitative synthesis. In general, four of the five studies demonstrated that vestibular rehabilitation is an effective intervention for individuals with concussion-induced vertigo. The other study showed that the presence of visual disorders does not preclude individuals from experiencing the positive effects of this type of therapy. Some exceptions did occur in three of the studies. One study showed that there was no significant difference in scores from pre-test to post-test according to one of the five outcome measures, likely due to the possibility that the participants began using coping strategies prior to the beginning of the vestibular rehabilitation program. A second study showed that there was no significant difference in scores between the participants who were medically cleared to return to sport and those who were not according to two of the three outcome measures, likely due to the possibility that the sample size was too small. A third study showed that the difference in scores from pre-test to post-test for one of the participants did not exceed the known smallest detectable change when both outcome measures were used, likely due to the fact that this participant experienced cervical pain and sustained a more serious head injury compared to the other participants.

Conclusions: In general, vestibular rehabilitation is an effective intervention for individuals with concussion-induced vertigo, even in the presence of visual disorders.

Clinical Relevance: Vestibular rehabilitation should be considered as a component of the plan of care for individuals who experience vertigo following a concussion.
TITLE: A Retrospective Analysis for Preliminary Identification of Fall Risk Factors in the Stroke Population at a Community-Owned Healthcare System

AUTHORS/INSTITUTIONS: K.A. DeLave, Z. Kadivar, M.F. Lyon, Outpatient Rehabilitation, TIRR Memorial Hermann, Houston, Texas, UNITED STATES|A. Miller, Inpatient Rehabilitation, HealthSouth, Sugar Land, Texas, UNITED STATES

ABSTRACT BODY:
Purpose/Hypothesis: For 6.6 million stroke survivors in the United States, falls are disabling and result in injury, fear of falling, and decreased activity levels. Furthermore, up to 55% of people seek medical attention after a fall and direct medical costs are $34 billion annually. Fall risk has been studied extensively post-stroke. Variables such as balance deficits and dependency in ADLs are consistently identified. However, findings have been inconsistent across sites and previous authors have called for population-specific fall risk assessment tools. The purpose of this study was to define the ambulatory stroke population at Harris Health System, a public healthcare system, and to identify variables that may relate to fall risk.

Number of Subjects: 96

Materials/Methods: A retrospective chart review was completed on outpatients evaluated at Quentin Mease Community Hospital between December, 2015 and August, 2016. Inclusion criteria were age >18 yrs, stroke diagnosis, and ability to ambulate >50 ft requiring no >25% assistance. Demographic variables, fall history, and baseline functional outcomes were collected. Fall and non-fall groups were compared and a logistic regression was used to explore if these factors could predict falls.

Results: Sample demographics: mean age 54.5 yrs +11.4 yrs, 34% female, 47% African American, and 73% uninsured. Falls occurred in 50% of patients; of those, 34% had an injurious fall and 31% sought medical attention. Fallers were significantly more likely to have sustained a stroke >1 yr prior to evaluation (p=0.002), to have upper extremity (UE) hypertonicity (p=0.012), to use an assistive device (p= 0.012), and to have visual deficits (p=0.036), particularly visual deficits new since stroke onset (p= 0.032). The final logistic regression model included time since stroke (p=0.002), visual deficits (p=0.022), and UE hypertonicity * visual deficits (p=0.024). This model was significant at $\chi^2(3)=15.25$, p=.002, and correctly classified 64% of cases. In a subset of subjects, no significant differences were found between fallers and non-fallers for health literacy, gait, and balance testing. Fallers were more likely to be classified as household ambulators (gait speed < 0.4 m/s), but this difference was not significant.

Conclusions: In the ambulatory post-stroke population at Harris Health System, stroke chronicity and visual deficits may be predictors of falling. Socioeconomic factors did not differ between fallers and non-fallers as might be suspected in a public health setting. Baseline outcome measures were not different between groups and fall risk cutoff scores previously published for post-stroke and geriatric populations did not accurately distinguish fallers from non-fallers.

Clinical Relevance: The results of this study further support population-specific fall risk analyses. The creation of site-specific tools will provide justification of care and influence practice to improve patient outcomes and decrease costs associated with falls, which is relevant for public health systems.
Title: Efficacy of Virtual Reality and Visual Illusion on Neuropathic Pain in Spinal Cord Injury: A Systematic Review

Authors/Institutions: R.A. Nielsen, Physical Therapy, University of Mississippi Medical Center, Jackson, Mississippi, United States | L.J. Barnes, K.J. Curbow Wilcox, Physical Therapy, University of Mississippi Medical Center SHRP, Jackson, Mississippi, United States

Abstract Body:

Purpose/Hypothesis: The purpose of this systematic review is to assess the evidence concerning virtual reality and visual illusion training in the effective management of neuropathic pain in people with spinal cord injury.

Number of Subjects: NA due to systematic review.

Materials/Methods: Search Strategy: A search of PubMed, CINAHL, Scopus, and Embase databases was conducted in November, 2016, using identical search terms. The electronic search yielded 38 total articles. The duplication screen eliminated 21 articles with 17 remaining. Five additional articles were eliminated with the title screen, resulting in 12 remaining articles. The abstract screen eliminated three articles with nine remaining. Following application of the inclusion and exclusion criteria, six articles remained for review. Articles were evaluated using PEDro and the 2011 Oxford Centre for Evidence-Based Medicine (CEBM) scale.

Results: Following the conclusion of the electronic search and screening process, six articles were chosen for review. Five of the six articles demonstrated that virtual reality and visual illusion have a positive effect on neuropathic pain intensity and quality in people with spinal cord injury. The level of evidence for the six articles according to the CEBM revealed two level II studies, two level III studies, and two level IV studies.

Conclusions: The inclusion of virtual walking within a rehabilitation protocol may lead to significant reduction in neuropathic pain quality and intensity in people with spinal cord injury. Additionally, some evidence indicated that virtual lower extremity exercises may also lead to reduced neuropathic pain. In the specific articles reviewed, virtual illusion or virtual reality were shown to be a reasonable consideration for alternative neuropathic pain management when compared to the effectiveness of pharmacological interventions.

Clinical Relevance: Clinically, the inclusion of virtual illusion or virtual reality as a rehabilitation intervention may provide a unique and enjoyable interactive activity that physically challenges the client with spinal cord injury and leads to pain relieving benefits.

AUTHORS/INSTITUTIONS: M.F. Lyon, D. Wingard, Outpatient, TIRR Memorial Hermann, Houston, Texas, UNITED STATES| G.A. Brusola, Outpatient Physical Therapy, TIRR Memorial Hermann, Houston, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study is to investigate the influence of patient cognitive function on the inter-rater reliability of three clinical balance outcome measures in individuals with history of traumatic brain injury (TBI).

Number of Subjects: 15

Materials/Methods: Fifteen community-dwelling individuals with history of TBI, able to stand one minute and walk 20 feet were recruited. Each participant completed the Montreal Cognitive Assessment (MoCA), Berg Balance Scale (BBS), Functional Gait Assessment (FGA) and mini-Balance Evaluation Systems Test (mini-BEST). Assessments were completed by licensed physical therapists who work in an outpatient neurological rehabilitation setting and have clinical experience treating individuals with TBI and administering the included balance assessments. Inter-rater reliability was determined for the sample and two sub-groups dichotomized by MoCA score below and above the sample median. Intra-class coefficient (3,1) was used for all reliability calculations.

Results: Descriptive statistics will be reported numerically for categorical data (gender, mechanism of injury, assistive device) as a percentage and as means, standard deviations, and ranges for numerical data (age, number of medications, number falls in last 6 months, number of injurious falls, months since onset of injury). Interclass correlations of the BBS were found to be r=.986 (.960-.995), p<0.0005, the FGA r=.995 (.985-.998), p<0.0005, and mini-BEST r=.985 (.956-.995), p<0.0005. Data were then stratified into sub-groups: 1) equal to or below the median score (22/30) on the MoCA and 2) above the median score on the MoCA. For the BBS low MoCA subgroup, r=.9846 (.917-.997), p<0.0005, and high MoCA subgroup, r=.967 (.839-.994), p<0.0005. The FGA low MoCA subgroup r=.997 (.985-.999), p<0.0005, high MoCA subgroup, r=.982 (.903-.997), p<0.0005. The mini-BEST low MoCA subgroup r=.987 (.939-.997), p<0.0005, and high MoCA subgroup, r=.967 (.902-.997), p<0.0005.

Conclusions: All measures were found to be reliable between raters regardless of cognitive function, as measured by MoCA.

Clinical Relevance: Most individuals with TBI have residual deficits, including balance impairments that can have a detrimental impact on quality of life. Though there are extensive reliable and valid measures available to measure balance in individuals living in the community with neurological diagnoses, limited evidence exists to support use of balance measures after TBI. Tool(s) that are supported by psychometric studies as reliable and valid will allow clinicians to support goal setting, guide clinical decision making, and enhance communication. Results of this study support reliability of measures independent of cognitive function.
Purpose/Hypothesis: Increasingly, patient-reported outcome measures are used to gather patient perceptions and perspectives in clinical trials and rehabilitation practice. Relationships between and among patient-reported and clinician-administered performance-based measures, however, are seldom reported in the literature, leaving many to question their validity.

Number of Subjects: n=361

Materials/Methods: The recent large phase 3 randomized controlled trial, the Interdisciplinary Comprehensive Arm Rehabilitation Evaluation stroke initiative (ICARE), provided an opportunity to assess relationships of commonly used measures across the International Classification of Function (ICF) spectrum of body function and structure, activity, and participation obtained through patient self-report and clinical laboratory performance. Measures examined included: the patient-reported Stroke Impact Scale (SIS) Strength (body function/structure) and Hand (activity) subscales, Motor Activity Log-Quality of Movement (MAL-QOM, activity), and Reintegration into Normal Living Index (RNLI, participation), and performance-based Fugl-Meyer Assessment of Upper Extremity motor capability (FMA, body function/structure), and the Wolf Motor Function Test (WMFT) time score (activity). Relationships among measures were examined with Spearman correlations across assessment methods, time post-stroke, and within and across ICF levels and instrument content emphases.

Results: Strength of relationships among measures appears to reflect distinctions in measure content and to some extent methodological approach. Relationships obtained in the ICARE trial were consistent with those reported in the literature with smaller sample sizes and varied time since stroke. Moderately strong relationships were observed between impairment and activity measures whether with same or mixed methods: FMA and WMFT (rho = -.711, p < .001) and FMA and SIS Hand (rho = .653, p < .001). Although levels of body function/structure, activity, and participation all rose (i.e., improved) over the course of this rehabilitation trial, relationships between measures were stable over time from early post-stroke (e.g., WMFT-SIS Hand, rho = -.631, p < .001 at baseline 46 days on average post-stroke) to one year later (rho = -.635, p < .001). The participation measure, however, had stronger relations with impairment (FMA) and activity assessments as time from stroke increased, though only 16.1% of the variation in participation was attributable to arm and hand impairment at 1 year.

Conclusions: Both patient-reported and performance-based measures exhibited meaningful and expected relationships with each other as a function of instrument content and across measurement methods, lending additional validation to both types of measures.

Clinical Relevance: The emphasis on patient-reported outcomes within the patient-centered care movement is well supported in the stroke rehabilitation literature and may yield additional clinical opportunities to examine patient progress and intervention effectiveness.
A preliminary investigation on the neural correlates of human dual-task walking

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Purpose/Hypothesis: Movement control requires precise, sophisticated coordination between the motor and cognitive systems. Automatic execution is exhibited in well-learned skills, such as walking, that has complex implications when a secondary task is introduced. Dual-task walking often declines with age and in individuals with neurological deficits. The dorsal lateral prefrontal cortex (DLPFC) and supplementary motor area (SMA) have been shown to play an important role in dual-task gait, though there is a paucity of research examining SMA's role. This study was designed to further determine the neural correlates of dual-task walking in young healthy individuals via repetitive transcranial magnetic stimulation (rTMS). Specifically, we investigated two hypotheses: [1] that high frequency rTMS applied to the DLPFC would significantly improve dual-task walking while low frequency would have the opposite effect and [2] that high frequency rTMS applied to the SMA would significantly improve dual-task walking while low frequency would have the opposite effect.

Number of Subjects: 16

Materials/Methods: Sixteen participants, 11 females and 5 males, mean age of 29 years, were randomized to either a high frequency (5Hz, N = 7) or low frequency (1Hz, N = 9) rTMS group. Each participant attended 3 testing sessions (7 ± 2 days apart) in which rTMS was applied to different neural loci, left primary motor cortex (M1), SMA and DLPFC. The order of stimulation sites were randomized across sessions and counterbalanced among participants. Gait performance was assessed under single and dual-task conditions on a GaitRite carpet walkway before and after rTMS application. During the dual-task gait, participants counted backward by 3 from a given number. Gait speeds under single and dual-task conditions were used to compute dual-task cost (in %) and served as the primary outcome. Repeated measure ANOVA was used for statistical analysis.

Results: All participants showed a significant reduction in gait speed under the dual-task condition (p < .01). There was a borderline group by time interaction in dual-task cost (p = .07) after rTMS applied to SMA with the high frequency group showed a reduction in dual-task cost (pre = 33%; post = 26%) after rTMS while the low frequency group showed no changes. rTMS applied to M1 and DLPFC did not result in any group differences in dual-task cost. A subsequent analysis revealed that 5Hz rTMS applied to SMA significantly increased gait speed under dual-task condition (p = .03).

Conclusions: High frequency rTMS stimulation to the SMA tended to reduce dual-task cost in young healthy adults by increasing dual-task gait speed. Contrary to the hypothesis, rTMS to the DLPFC did not change dual-task cost.

Clinical Relevance: Dual-task walking is often compromised among elderly and individuals with neurological disorders. Identifying neural substrates supporting dual-task walking provides the basis for developing targeted interventions for populations participating in physical therapy.
**TITLE:** Exoskeleton Gait Training for Left Middle Cerebral Artery Infarct in Patient Supported with Left Ventricular Assistive Device: A Single Case Study

**AUTHORS/INSTITUTIONS:** M.K. Trammell, Acute Rehabilitation, Baylor Institute for Rehabilitation, Frisco, Texas, UNITED STATES|K.B. Patterson, Physical Therapy, Baylor Institute for Rehabilitation, Dallas, Texas, UNITED STATES

**ABSTRACT BODY:**

**Background & Purpose:** Chronic heart failure affects 5.7 million people in America. Implantation of a left ventricular assistive device (LVAD) is an increasingly used treatment. Yet, the need for postoperative treatments following LVAD can result in complications, including stroke, which is reported in 8 to 25% of patients. A stroke after LVAD placement can make the use of conventional therapies such as body weight support gait training challenging in inpatient rehabilitation due to drive line site. Thus, there is a need to improve gait and treatment options for safe ambulation. Exoskeletons may provide an opportunity for controlled repetition and intense training for these complex patients. As there is no published literature specific to exoskeleton use and patients with stroke after LVAD our objective is to describe a case study.

**Case Description:** Participant was a 55 year old male undergoing inpatient rehabilitation with chronic systolic heart failure with LVAD, right middle cerebral artery infarct, followed by a left middle cerebral artery infarct with hemorrhagic conversion. Patient impairments included residual left hemiparesis with new right motor apraxia, spasticity, dysphagia with PEG placement, and global aphasia. The patient was able to follow simple 1 step commands and express needs, total assist for transfers, was unable to walk, and total assist for sitting and standing balance. While working with the therapist, the participant was able to progress from standing frame to standing at hemi-bar and was thus deemed appropriate for exoskeleton gait training.

**Outcomes:** Participant began exoskeleton gait training 16 days from admission. Prior to initiating exoskeleton gait training, the patient was unable to walk over ground or use body weight support systems, and required 2 person assist for standing. In the exoskeleton, the participant demonstrated improvement with walk time, up time, and total number of steps. Participant improved with quality of gait resulting in decreased assistance of exoskeleton overtime. The use of exoskeleton was less physically demanding on the therapist and allowed the patient to ambulate. Participant’s blood pressure and MAP remained within recommended medical limits pre and post use and no LVAD alarms were elicited throughout sessions. Participant expressed increased levels of motivation throughout exoskeleton use and demonstrated no complaints of discomfort near LVAD site.

**Discussion:** Literature supports early exercise and walking as safe and crucial therapeutic modalities for motor recovery, functional outcomes, and quality of life. Despite ambulation being one of the primary rehabilitation goals, 30-40% of patients with stroke are limited or not walking after rehabilitation. This case study indicated that exoskeleton use increased walk time, improved gait, and was safe for a patient with stroke following LVAD placement. Continued examination of exoskeleton use is needed to explore alternative ways to ambulate patients that are medically complex.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
7. Louie D, Eng J. Powered robotic exoskeletons in post-stroke rehabilitation of gait: a scoping review; Journal of
NeuroEngineering and Rehabilitation; 2016.
TITLE: Comparison of Balance Performance on Force Platform Measures in Individuals with Parkinson Disease and Healthy Adults

AUTHORS/INSTITUTIONS: C.C. Harro, C. Hargis, A. DeWitt, A. Kelch, Physical Therapy, Grand Valley State University, Grand Rapids, Michigan, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Postural instability is a known contributing factor to balance dysfunction and increased fall risk in those with Parkinson disease (PD). The NeuroCom® Force Platform System (FP) provides objective, quantitative information regarding balance impairments in voluntary and reactive postural strategies and sensory integration. The purpose of this study was to examine balance performance as measured by the Limits of Stability (LOS), Sensory Organization Test (SOT), and Motor Control test (MCT) utilizing the FP system in persons with PD as compared to healthy adults. Secondarily, this study examined if these FP measures provide diagnostic and clinically meaningful information about the underlying balance impairments in the PD population.

Number of Subjects: Forty two individuals with PD (H&Y stage= 2.33 ± 0.77; age= 66.21 ±7.92 years) and 55 gender and age-matched healthy controls enrolled in this study.

Materials/Methods: Balance measures (SOT, MCT, LOS) were assessed in both cohorts using standardized procedures on NeuroCom® Smart Equitest Clinical Research System/Balance Master System 9.1. Between group comparisons of FP performance were conducted using Independent t-test. ANCOVA was also analyzed controlling for age. Within group comparisons for the PD cohort were performed using ANOVA for comparing disease stage and age groups, and the Mann Whitney-U Test for comparing PD-subtypes.

Results: Significant between group differences in FP performance were found for the SOT composite equilibrium (P= 0.013, CI-95% 1.286 to 10.37), SOT vestibular ratio (P= 0.027, CI-95% =0.12 to 0.185), SOT number of total falls (P= 0.015, CI-95% =-1.527 to -0.175) and LOS average movement velocity (P= 0.001, CI-95% =0.597 to 1.595). ANCOVA findings estimated that on average the healthy cohort scored 5.28 points higher in SOT composite equilibrium than the PD cohort. Within group analysis revealed significant differences in FP performance based on age, stage and PD subtypes.

Conclusions: Individuals in the PD cohort demonstrated greater postural instability on SOT measures and slower movement velocity on LOS than the healthy cohort, suggesting that these tests were sensitive to detect sensory integration and voluntary postural control deficits in the PD cohort. The SOT differentiated between disease stages 1-3, supporting the use of the SOT to identify decline in sensory integration with advancing disease stage. The MCT demonstrated a decline in reactive postural control mainly in later disease stages. The LOS and MCT distinguished between PD subtypes with the posture instability/gait difficulty subtype demonstrating poorer balance performance.

Clinical Relevance: These findings support that FP measures may provide clinically meaningful, diagnostic information in the examination of balance impairments in individuals with PD. In response to the high fall rate and devastating sequelae of falls in individuals with PD, FP measures may inform clinicians regarding intrinsic balance deficits and guide them in designing targeted balance interventions to reduce fall risk.
Return to Run: A Six Week Program for an Individual Post Traumatic Spinal Cord Injury: A Case Study

N. DeGeorge, Elmhurst Memorial Hospital, Aurora, Illinois, UNITED STATES|J. Kelly, ATI Physical Therapy, Geneva, Illinois, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Returning to running after a significant neurologic injury is not a typical goal of intervention. Consequently, information on return to run programs for this population is limited; with the majority of research based on those with brain injury. The purpose of this case study is to present the results of a return to run program for an individual one year post traumatic, incomplete spinal cord injury (iSCI).

Case Description: Individual is a 26 year old male diagnosed with C6 iSCI (ASIA D) after sustaining an injury while hiking. He presented to an outpatient physical therapy clinic seven months post injury wearing a cervical collar and ambulating independently with a straight cane. His primary goal was to return to running. Once cleared by his physician, he consented to enroll in a six week return to run program. The program consisted of 90 minute sessions two times per week. Sessions included strength and balance training as well as gait/running specific training. Outcome measures collected before and after the six week program included: gait speed, six minute walk test [6MWT], eight item High-level Mobility Assessment Tool [HiMAT], the Consequences of Falling Scale [CoF], the Activities-specific Balance Confidence Scale [ABC], Self-Efficacy for Exercise Scale [SEE], and the University of Illinois at Chicago Fear of Falling Measure.

Outcomes: After completion of the six week program the individual demonstrated improvements in all outcome measures. Significant improvements were achieved in self-selected (Δ 0.09 m/s) and fast walking speeds (Δ 0.29 m/s) as well as in the 6MWT (Δ 163.6 ft.). Pt’s self-efficacy and confidence were markedly increased over the course of the program. The change in HiMAT score was not significant based on data obtained for those with traumatic brain injury.

Discussion: After completion of the program, the individual was able to demonstrate an improved running pattern and participate more fully in recreational activities requiring running. Though improvements in physical outcome measures were achieved over the course of the program were significant, most striking were the improvements in the psychosocial measures. This was reflected in his confidence to participate in other premorbid activities he was apprehensive to try prior to entering this program (such as hitting a baseball). By affecting one’s self-efficacy and confidence we may open doors to participation in activities that are important to the individual, thereby reducing the severity of disability and increasing their quality of life.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: In adults with chronic stroke, is action observation with intent to practice more effective than training with non-meaningful visual feedback to improve upper extremity function?


ABSTRACT BODY:

Purpose/Hypothesis: Action observation is a known neurophysiological priming mechanism believed to promote neuroplasticity and motor learning. This technique involves observing a motor task, which activates similar cortical areas (known in humans as the extended mirror neuron system) that are activated during performance of the actual movement. The purpose of this review is to determine if there is an additive effect of action observation with intent to practice to improve upper extremity function in adults with chronic stroke.

Number of Subjects: N/A

Materials/Methods: CINAHL and PubMed were searched for articles from 2006-current using keywords “CVA OR Stroke” AND “action observation” AND “movement OR motor impairment OR function OR strength”. Inclusion criteria: 1) adults over 18 years of age with upper extremity hemiparesis and at least 6 months post-stroke 2) studies that utilized action observation followed by training. Exclusion criteria: 1) studies without functional outcomes 2) studies with interventions that were mixed/combined.

Results: Five studies were retained [1-5]. Three studies were randomized controlled trials, one a single group intervention design, and one a crossover design. The studies had Oxford CEBM levels of evidence ranging from 2-3 and PEDro scores of 6-7. Participants in all studies had a mean age between 54-68, chronic stroke, and min-mod UE paresis. All studies showed an improvement in upper extremity function when action observation was added to practice. Two studies [1, 2] found a significant improvement compared to their control groups. Franceschini et al. [3] indicated an increase in the Upper Extremity Fugl-Meyer Assessment in the intervention group greater than the MCID. Minimal differences were found between the intervention and control group in the Lee et al. (2013) study that utilized low dosage (1.7 mean movements).

Conclusions: Based on good quality evidence, action observation may be an effective adjunct intervention to improve upper extremity function in individuals with chronic stroke and min-mod UE paresis. Additionally, better outcomes in quality of life and activities of daily living were reported in those who practiced action observation compared to those who received dose-matched practice with non-meaningful visual feedback.

Clinical Relevance: Action observation with intent to practice is a well tolerated intervention that may be beneficial as an adjunct to skilled therapy for people with min-mod UE deficits post chronic stroke.
TITLE: Improving Balance through Virtual Reality and Physical Therapy Integration

AUTHORS/INSTITUTIONS: B.S. Esguerra, K.M. Johnson, Doctor of Physical Therapy, University of St. Augustine for Health Sciences, San Marcos, California, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Virtual reality (VR) is an innovative technology that shows promise in the assistance of physical therapy (PT). The amount of control, variability, and customization that is inherent in virtual reality can assist in comprehensive and consistent treatment. This case report explores the use of virtual reality with a patient suffering from unilateral vestibular hypofunction (UVH).

Case Description: A 50-year-old male was referred to PT following a motor vehicle accident. He was diagnosed with having an acute left UVH, accompanied by reports of dizziness, imbalance and gait disturbances. Working in construction, the patient’s decreased balance, disequilibrium, and gait disturbances limit him from participating in full-time work activities. Additionally, the patient is unable to drive longer than one hour without increasing symptoms of dizziness. The patient was treated in an outpatient vestibular clinic for eight weeks, two to three times a week for 40-minute sessions. He participated in a vestibular rehabilitation program for four weeks as recommended for a patient with acute UVH. Research has shown vestibular impairments may require up to eight weeks of therapy before seeing significant improvements. For the next four weeks, the patient performed his vestibular exercises within VR. The goals of VR were to provide task-specific simulations to improve postural balance, decrease anxiety through exposure therapy, and improve smooth eye pursuits to improve static balance.

Outcomes: According to the International Classification of Function, Disability and Health, outcome measures of body function and structure included the Sensory Organization Test and the Motor Control Test. These tests were performed using a NeuroCom SMART Balance Master® device. Outcomes measuring activity limitations include the Activities-Specific Balance Confidence Survey and the Functional Gait Assessment (FGA). Outcomes measuring participation limitations include the Dizziness Handicap Inventory (DHI). Outcome measures were performed at initial evaluation, at the 10th visit, and again at discharge. Notable improvements were seen on FGA and DHI scores. His FGA scores, with a minimal clinical important difference (MCID) of 8 points, improved from 21 to 29. Placing the patient at a falls risk to no falls risk. The greatest improvement the patient showed was in his DHI scores, with MCID of 4 points, from 74 to 4. Placing the patient on range from a severe vestibular impairment to a mild vestibular impairment.

Discussion: Dizziness, confidence, balance, and gait improved following vestibular rehabilitation combined with VR. Outcomes of this case suggest that virtual reality in conjunction with vestibular rehabilitation therapy is effective in improving deficits of unilateral vestibular hypofunction. Additionally, VR has been shown to be an additional tool for assisting physical therapists in providing interventions that meet the patient’s needs and goals.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Making the “MOST” of a one day wellness retreat for individuals with Parkinson’s disease: A qualitative case study

AUTHORS/INSTITUTIONS: M. Danzl, E. Ulanowski, C.A. Paydo, B. Jacquelyn, Physical Therapy, Bellarmine University, Louisville, Kentucky, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Parkinson’s disease (PD) can cause a loss of social relationships, decreased participation in leisure activities, and diminished quality of life. Exercise improves PD-related symptoms and quality of life yet individuals with PD face many barriers to exercise participation. PD-tailored community-based group exercise and wellness retreats may abate these barriers. Given the paucity of evidence examining this, the purpose of this qualitative study is to examine the value of a one-day wellness retreat for individuals with PD and caregivers.

Case Description: The retreat was designed and led by physical therapists with support of student volunteers. The retreat included group activities, meditation, yoga, outdoor walking, amplitude-based exercises, education, and socialization. A qualitative case study design was used, bounded by program (retreat), participants (individuals with PD; caregivers), and time (one-day). A phenomenological lens was employed to examine the lived experience of the individuals in the context of participating in the program. Participants (n=11 individuals with PD; n=4 caregivers) were recruited through purposeful sampling and provided informed consent. Data collection included participant observations, field notes, photographs, and focus groups. Data analysis involved coding the transcribed focus groups and participant observations for patterns. The photographs and field notes were used for triangulation.

Outcomes: Participants made the MOST out of the experience through: M (multifaceted activities), O (obtaining information), S (social support), T (training). Participants valued the opportunity to participate in multifaceted activities within the retreat (e.g., yoga, outdoor walking) and felt inspired to continue them post-retreat. Participants described the value of obtaining information by learning from others, both retreat leaders and participants. The social support provided a sense of camaraderie, motivation, opportunity to share one’s experiences with others, and a sense that one is not alone. Participants shared that the training provided by leaders alleviated fears, fostered confidence, and enabled the trial of new things and a rise to the challenge of the intensity prescribed. Caregivers who did not attend the retreat described the value of respite.

Discussion: This report describes the value of a PD-tailored one-day wellness retreat including key features of the program highlighted by participants. Suggestions for future work include assessment of the effects of intense physical activity through a wellness retreat on quality of life, physical performance measures, and exercise self-efficacy. This work describes a novel service delivery model designed by physical therapists for individuals with PD. For translation to practice, these findings highlight the importance of education and referrals to community-based group programs. This work also provides an example of student involvement in service that supports advocacy for coverage of wellness initiatives.

TITLE: Association of Physical Activity with Psychosocial Variables and Non-Motor Symptoms in Parkinson’s disease: A cross-sectional study

AUTHORS/INSTITUTIONS: M. Danzl, E. Ulanowski, C.A. Paydo, Physical Therapy, Bellarmine University, Louisville, Kentucky, UNITED STATES|P.D. Loprinzi, Health, Exercise Science and Recreation Management, The University of Mississippi, University, Mississippi, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: To describe the free-living, accelerometer-assessed physical activity (PA) patterns in individuals with Parkinson’s disease (PD) and examine association with psychosocial variables and non-motor symptoms.

Number of Subjects: 25 subjects with PD (56.5% male; average age 68.7 years, range 51-85; average Hoehn and Yahr Score 2, range 1-3)

Materials/Methods: In this cross-sectional study, subjects wore an accelerometer during all activities (except water-based activities and sleeping) for 1–2 weeks to capture PA patterns including moderate-to-vigorous PA (MVPA). Subjects also completed the 39-item PD Questionnaire, Fatigue Severity Scale, Apathy Evaluation Scale, Self-Efficacy for Exercise scale, International Physical Activity Questionnaire, Sedentary Behavior Questionnaire, Social Support Questionnaire, and the Beck Depression Inventory. Multivariate linear regression analysis was employed to examine the association of PA with psychosocial variables and non-motor symptoms.

Results: Data from 23 subjects was analyzed (2 malfunctioning accelerometers). Average MVPA was 10.6 minutes/day (range 0–73.7). Average light-intensity activity was 259.9 minutes/day (range=125.7–404.6). Only 17.4% of the subjects met MVPA guidelines but engaged in more sedentary behavior than light-intensity activity. The remaining 82.6% of the subjects did not meet MVPA guidelines and engaged in more sedentary behavior than light-intensity activity. After adjustment for the severity of PD symptoms (Hoehn and Yahr), those who engaged in greater moderate-intensity PA had greater levels of social support (β=0.37; P=0.03), and greater exercise self-efficacy (β=1.3; P=0.04). Those with more fatigue engaged in less moderate-intensity activity (β=-0.29, P=0.08) and those with lower apathy engaged in more moderate-intensity activity (β=0.64, P=0.06) but these findings were not statistically significant. Moderate-intensity PA was not associated with quality of life (β=-0.42; P=0.35) or depression (β=-0.05, P=0.62). Sedentary behavior, light-intensity activity, or vigorous activity were not significantly associated with any of the evaluated psychosocial variables or non-motor symptoms.

Conclusions: The main findings indicate: 1) individuals with PD with greater levels of social support engage in more moderate-intensity PA and 2) there is a relationship between engaging in moderate-intensity PA and greater exercise self-efficacy. These findings persisted after adjustment for the severity of PD related symptoms. Limitations of this study include the cross-sectional study design (precluding the ability to establish temporal sequence), nonrandomized subject selection, and sample size.

Clinical Relevance: The results of this study suggest positive relationships between engagement in moderate-intensity PA and exercise self-efficacy and social support. The data provides a springboard for patient education about increasing PA, referral to support groups, and efforts to improve self-efficacy.
TITLE: Retraining Sensory Weighting Using Virtual Environment and Vibrotactile Biofeedback

AUTHORS/INSTITUTIONS: A. Hebron, B. Schwarz, V. Kowalewski, N. Bugnariu, Physical Therapy, University of North Texas Health Science Center, Fort Worth, Texas, UNITED STATES| R. Patterson, Family Medicine, UNTHSC, Fort Worth, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The aim of this study was to evaluate the effectiveness of a balance rehabilitation protocol to retrain the sensory weighting mechanism by utilizing vibrotactile feedback and training in virtual environment (VE).

Number of Subjects: 20

Materials/Methods: 20 participants, 10 non-diabetic young adults (NDYA) and 10 diabetic older adults with peripheral neuropathy (DAPN). We experimentally induced somatosensory loss in NDYA with inflated pressure cuffs on the ankles for 35 min and then placed a vibrotactile system with low and high frequency stimulation. Data was collected at baseline and during the last 15 minutes of the ischemic protocol under three conditions: no vibration, low frequency and high frequency vibrations. Outcome measures included center of pressure (COP) variability, plantar surface pressure sensation and vibratory threshold.

The DAPN participated in 6 (1-hour) training sessions with visually engaging VE which progressively challenged walking and balance tasks. Vibrotactile devices were placed around ankles, above the level of sensory loss, delivering constant sub-threshold white noise stimulation. In visits 1 and 8 pre- and post-training functional assessments of balance and gait function were conducted.

Results: In NDYA, ischemia increased COP variability and plantar surface pressure sensation threshold (p=0.01 and p= 0.3 respectively) and decreased the vibratory extension threshold measured at the hallux IP joint (p<.001). Vibrotactile stimulation at sub-threshold frequency restored baseline values. In DAPN, comparisons of pre- and post-training data revealed increased ABC score (p=0.02), no significant change in TUG (p=0.24), decrease in sway index during CTSIB for eyes closed conditions both on stable and foam surface (p <0.05) and increased self-selected gait speed (p<0.05). Subjects were able to maintain a straight walking trajectory even in the presence of visual inputs entraining lateral movements.

Conclusions: The vibratory biofeedback was able to partially compensate for the experimental induced sensory loss and improve balance function in healthy young adults. Results of the training protocol suggest support for the stochastic resonance theory and show that sensory retraining in VE and vibratory device is feasible in diabetic subjects holding promise for improvement of function due to an increased ability to integrate all sensory inputs available and a decreased reliance on visual inputs.

Clinical Relevance: The somatosensory system is an integral part of balance control and this function declines or is absent in older adults with diabetic neuropathy resulting in diminished motor performance and an increased fall risk. Falls are a leading cause of injury and disabilities in multiple patient populations and these injuries result in significant health care cost and a decrease in patient quality of life. The ability to dynamically reweight multiple sensory inputs is critical to decreasing falls. This study has provided a possible solution to increasing somatosensory input while dynamically training balance and postural control.
Purpose/Hypothesis: Up to 50% of all individuals with migraines experience vertigo. Although most of the treatment options used to manage these types of individuals are pharmacologic in nature, the use of vestibular rehabilitation has also been proposed. The purpose of this systematic review was to evaluate the effectiveness of vestibular rehabilitation at managing individuals who experience vertigo in conjunction with their migraine headaches.

Number of Subjects: N/A

Materials/Methods: The CINAHL Complete, ProQuest Medical Library and PubMed databases were accessed using the following search terms: "migraine" AND "vestibular rehabilitation" OR "vestibular therapy" AND "vertigo". The systematic review used the following inclusion criteria: (1) individuals who experience vertigo in conjunction with their migraine headaches, (2) the use of vestibular rehabilitation techniques as the intervention, (3) the use of a non-vestibular intervention or a sham intervention as the comparison if the research study is a randomized controlled trial, and (4) the use of a participation outcome measure described by Whitney and Sparto and/or the use of a visual analog scale as the outcome measure. A tool developed by the Oxford Centre for Evidence-Based Medicine was used to examine the evidence level of each included research study, and a tool developed by Medlicott and Harris was used to examine the methodological rigor of each included research study.

Results: Seven hundred ninety-one records were located through a search of the three electronic databases. Two related records were located through other means. The systematic review was eventually comprised of four articles that met the inclusion criteria. Vestibular rehabilitation was found to be generally more effective for participants who were diagnosed with a non-migrainous vestibular disorder than it was for participants who had a vestibular disorder as well as a migraine history. In addition, vestibular rehabilitation was found to be generally more effective for participants who had a vestibular disorder as well as a migraine history than it was for participants who were diagnosed with vestibular migraines. However, additional research needs to be completed in this area. Because one author proposed that behavioral therapies may benefit those individuals who have been diagnosed with vestibular migraines, a randomized controlled trial that compares the effectiveness of a combined vestibular rehabilitation-behavioral therapy approach to the impact of using vestibular rehabilitation alone should be conducted. Two other authors suggested that the use of migraine medication may decrease an individual's sensitivity to head movements and may allow the individual to more fully participate in the vestibular rehabilitation program.

Conclusions: In all four studies, every group of participants benefitted to some degree from a customized vestibular rehabilitation program.

Clinical Relevance: Vestibular rehabilitation exercises should be seriously considered when treating individuals who experience vertigo in conjunction with their migraine headaches.
TITLE: Operant conditioning of the tibialis anterior motor evoked potential to transcranial magnetic stimulation in people with and without incomplete spinal cord injury

AUTHORS/INSTITUTIONS: R. Cote, College of Health Professions, Medical University of South Carolina, Charleston, South Carolina, UNITED STATES| A.K. Thompson, Health Sciences & Research, Medical University of South Carolina, Charleston, South Carolina, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Recovery of corticospinal function is essential for motor function recovery after spinal cord injury (SCI). Thus, a method that strengthens the corticospinal tract (CST) function might facilitate functional recovery in people with chronic CNS damage. We hypothesize that operant conditioning of the ankle dorsiflexor motor evoked potential (MEP) elicited by transcranial magnetic stimulation (TMS) can increase the excitability and strengthen the connectivity of CST, thereby alleviate foot-drop in people with incomplete SCI. As the first step, we investigated up-conditioning of the tibialis anterior (TA) MEP in neurologically normal subjects and subjects with chronic incomplete SCI, and measured MEP size, silent period (SP) duration, and maximum voluntary contraction (MVC) EMG amplitude.

Number of Subjects: Fifteen subjects (8 conditioning, ages 22-40 yrs and 7 control, 21-40 yrs) with no known neurological conditions and 10 conditioning subjects with incomplete SCI (ages 29-67 yrs).

Materials/Methods: The protocols consisted of 6 baseline and 24 conditioning (for conditioning subjects) or control (for control subjects) sessions (3/week for 10 weeks). In all sessions, TA MEPs were elicited by TMS at 10% above threshold while the sitting subject provided a fixed level (≈15% MVC level for normal subjects and ≈30% MVC level for subjects with SCI) of TA background EMG activity. In baseline and control sessions, 225 MEPs were measured with no feedback on its size. In conditioning sessions, during 225 conditioning trials the subject was encouraged to increase MEP, and was given immediate feedback indicating whether MEP size was above a criterion (i.e., whether the trial was a success). SP duration was measured from the time of stimulus to the return of pre-stimulus level of EMG activity.

Results: In normal subjects, MEP size increased in 5 of 8 conditioning subjects while it did not in the 7 control subjects: final MEP sizes (average of last 6 sessions) were 137.5±14.1% and 96.6±9.5% of the baseline value, respectively. SP duration decreased in both conditioning and control subjects, but to the significant extent only in the conditioning subjects (by ~8%, equaling ~10 msec). MVC did not change in the conditioning or control subjects. In 8 of 10 subjects with SCI, MEP size and MVC increased to 153.0±4.2% and 111.5±7.7% of the baseline values, respectively, while the SP duration decreased to 81.9±7.7% of the baseline value.

Conclusions: The results suggest that operant conditioning of the MEP is possible. It produces a focused facilitation of corticospinal excitation, rather than a general facilitation of excitation and inhibition in people with and without incomplete SCI.

Clinical Relevance: Targeting neuroplasticity to the CST through operant conditioning may facilitate motor function recovery in people with incomplete SCI, together with other therapeutic approaches.
Purpose/Hypothesis: Falls are very prevalent among older adults, often resulting in serious consequences including injury, hospitalization, and even death. In order to reduce fall risk, it is critical to accurately identify individuals at risk of falling. The Berg Balance Scale (BBS) is a performance-based outcome measure with well-established psychometric properties. However, the instrument’s ability to predict future falls is controversial. The purpose of this study was to determine whether the BBS would predict future fall status in a sample of community-dwelling older adults.

Number of Subjects: Forty-five people aged 65 and older (x = 83 years) completed the study. To participate, subjects had to live independently, be able to walk inside their homes (with or without an assistive device but without help from another person), and provide informed consent.

Materials/Methods: On the baseline test day, subjects reported clinical characteristics and completed the BBS. Those who scored <45/56 were classified “at risk of falling.” After testing, interviews were conducted every 3 months to determine whether a subject had fallen since the last point of contact. Subjects who reported at least one fall 12 months after testing were classified as “fallers,” while those who had not fallen were classified as “non-fallers.” Standard logistic regression was conducted to determine whether BBS scores significantly predicted fall status 12 months after testing. Chi-square was conducted to determine whether subjects determined to be at risk of falling at baseline were more likely to be fallers at 12 months. Descriptive statistics, Chi-square, and standard logistic regression were conducted in SPSS version 23.0.

Results: Overall mean score on the BBS was 48.4 ± 6.3. Eleven (24.4%) subjects were classified at risk of falling by the BBS. After 12 months, 16 (35.6%) subjects had reported at least one fall. Standard logistic regression indicated that the overall model fit of BBS score as a fall predictor was good (-2 Log likelihood=50.87) and statistically reliable in distinguishing future fall status \(X^2=7.71, p=0.005\). The model classified 75.6% of subjects correctly: 89.7% of non-fallers and 50.0% of fallers. Odds ratio indicated that better scores on the BBS decreased the likelihood of falling during the next 12 months (OR=0.86, 95% CI=0.77–0.97). Additionally, Chi-square revealed that subjects classified at risk of falling by the BBS at baseline were more likely to have experienced a fall after 12 months \(X^2=8.78, p=0.003\).

Conclusions: More than one-third of our subjects (35.6%) experienced at least one fall in 12 months. Balance performance, as measured by the BBS, was a significant predictor of future fall status in our sample of community-dwelling older adults.

Clinical Relevance: Using the BBS score alone as a predictor of fall status correctly classified the majority of non-fallers, but only half of the fallers. Using a combination of independent variables may identify future fallers with greater sensitivity, and warrant further investigation.
TITLE: Using the Tinetti to Predict Falls in Older Adults: a 12-month Prospective Study

AUTHORS/INSTITUTIONS: E. Skornyakov, K.K. Cleary, Eastern Washington University, Spokane, Washington, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Falls can lead to serious injuries, hospitalization, immobility, and even death. The Tinetti Performance Oriented Mobility Assessment (Tinetti) is an outcome measure widely used to measure balance performance and fall risk. However, there is conflicting evidence on its ability to predict future falls. The purpose of this study was to assess the Tinetti’s ability to predict future fall status in a sample of community-dwelling older adults, and determine whether the instrument’s fall risk threshold score was associated with fall status after 12 months.

Number of Subjects: Forty-five community-dwelling older adults (x = 83 years) completed the study. Subjects had to be 65 or older, live independently, and able to ambulate independently (with or without an assistive device) within their homes.

Materials/Methods: Subjects who scored <25/28 were classified at risk of falling. Following testing, interviews were conducted every 3 months to record the number of falls subjects had experienced since the last point of contact. After 12 months, subjects were classified as fallers (at least one fall) or non-fallers. Standard logistic regression was used to determine whether Tinetti score significantly predicted future fall status. Chi-square was used to assess the relationship between baseline fall risk and future fall status. Statistical analyses were performed in SPSS v 23.0.

Results: Twenty-one (46.7%) subjects were classified at risk of falling. Sixteen subjects (35.6%) were classified as fallers 12 months after testing. Chi-square revealed that subjects classified at risk of falling were more likely to be fallers at 12 months ($X^2=4.87$, p=0.03).

The mean sample score was 23.4 (± 4.6). Tinetti score significantly predicted fall status 12 months after testing [$X^2=5.71$, p=0.02]. The regression model classified 66.7% of subjects correctly: 86.2% of non-fallers and 31.3% of fallers. Odds ratio indicated that better Tinetti scores decreased the likelihood of a fall during the next 12 months (OR=0.86, 95% CI=0.73–0.98). Repeated logistic regression with the addition of baseline variables [fear of falling (yes/no) and fall history (number of falls in the previous year)] as predictors also produced a statistically significant model. The cases correctly classified improved to 81.8%: 89.7% of non-fallers and 66.7% of fallers [$X^2=15.24$, p=0.001].

Conclusions: In this study, performance on the Tinetti was a significant fall predictor. However, the model correctly classified less than one-third of our fallers. The addition of two simple variables, fear of falling and fall history, considerably improved the predictive model’s overall accuracy, particularly its classification of fallers.

Clinical Relevance: While performance on the Tinetti was a significant predictor of future fall status, only a fraction of fallers were correctly identified using Tinetti scores alone. The Tinetti is a useful tool in determining fall risk; however, the measure should be used in conjunction with other predictors to maximize the ability to identify future fallers.
TITLE: Use of visual feedback during body weight supported treadmill training to improve gait and balance in a person with an anoxic brain injury: A case report.

AUTHORS/INSTITUTIONS: S. O’Neal, N. Hoseini, A. Albers, N. Khosraviani, Physical Therapy, Midwestern University, Phoenix, Arizona, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Visual cues during gait have been shown to have a positive effect on dynamic stability and cadence during gait. Utilizing visual cues with the repetitive and task-oriented nature of body-weight supported treadmill training (BWSTT) can result in improvement of bilateral gait coordination and spatiotemporal characteristics in individuals with neurological dysfunction. There is limited evidence on the effect of visual cues and gait training with people with anoxic brain injuries. The purpose of this case study was to assess the effects of visual feedback during BWSTT on gait and balance with a person with an anoxic brain injury.

Case Description: A 27-year-old female with an anoxic brain injury, ataxic gait, wide base of support, decreased step length and inferior visual field deficits began BWSTT using visual targets and real-time visual feedback to promote better step pattern. The participant completed 16 sessions, 2x/week for 8 weeks. Two laser lights were affixed to the treadmill and aimed at the treadmill belt to promote decreased step width and increased step length. A video camera aimed at the targets was connected to a projector and projected on a wall in front of the participant to accommodate her visual impairments. This also allowed the participant to maintain upright posture during gait. Gait training included both forward and backwards walking and the participant was cued to step onto the target with each step and utilize the feedback on the wall to ensure success. The intervention started with two five-minute intervals of forward walking, and one five-minute interval of backwards walking progressing to 10 consecutive minutes of forward walking and two 5-minute backward walking intervals.

Outcomes: The participant demonstrated improvements between pre-test and post-test results in a majority of the outcome measures. Clinically meaningful change was shown in the 6 Minute Walk Test (227.0 m to 272.9 m; MDC: +36.6 m). Positive changes were shown in the Activities-Specific Balance Confidence Scale (53.1% to 61.25%; cut-off >67%), Timed Up and Go (18.95 s to 18.65 s), Timed Up and Go Cog (20.22 s to 18.45 s) and gait speed (0.88m/s to 0.91 m/s). The patient’s Mini-BESTest results remained consistent (19/28, 19/28). The patient also demonstrated decreased cadence during a 20 foot walk (124.3 steps/min to 112.4 steps/min).

Discussion: The participant demonstrated improvements in endurance, confidence, gait speed, and dual tasking after an 8-week intervention combining visual feedback and BWSTT. The participant also demonstrated decreased cadence along with decreased time during a 20-ft timed walk, therefore inferring improved step length. A twelve-week intervention should be taken into consideration, as there were positive trends in her improvement that could potentially reach clinically meaningful changes with increased time. This case study supports the use of combining visual feedback with BWSTT with a person with an anoxic brain injury.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Estimated clinically meaningful improvement in Arm Motor Ability Test scores for individuals with stroke
AUTHORS/INSTITUTIONS: R.A. Martin, G. Fulk, Physical Therapy, Clarkson University, Potsdam, New York, UNITED STATES|S.J. Page, OHIO STATE UNIVERSITY, Columbus, Ohio, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis: Hemiparesis is common in individuals with stroke and often correlates with a significant impairment of function. A 2014 systematic review provided strong support for repetitive, task-specific training to improve functional use of the upper extremity following stroke. Therapists often utilize tests and measures to gain a better understanding of the effect of chosen interventions. The Arm Motor Ability Test (AMAT) is commonly utilized as a measure of upper extremity (UE) function. Clinically important difference (CID) quantifies the amount of change required in a score to reasonably assume that the change would be viewed as important by an individual within the population studied. The CID for the AMAT has yet to be determined. The purpose of this study was to estimate the CID for improvement for the AMAT.

Number of Subjects: 146 participants with stroke who demonstrated mild to moderate UE hemiparesis (60% male, mean age of 57.1 years ± 11.0 [SD], mean time since stroke of 59.4 months ± 63.2 [SD], 60% affected greater on the right side, and 56% affected greater on their dominant side)

Materials/Methods: All participants completed the AMAT before and after a 6-week intervention period. Following the intervention period, the participant and their treating therapist each completed 5 global rating of change (GROC) questionnaires to quantify perceived change in different aspects of the participant’s upper extremity functional abilities. Receiver operating characteristic curves (ROC) were used to estimate the CID using the GROC ratings as anchors. The CID was also estimated through distribution-based methods.

Results: Following a 6-week intervention period, the mean change in AMAT score was 0.33. Utilizing the 5 different GROC scores based on therapist perception as anchors, estimated CIDs ranged from 0.34-0.42 (AUC 0.62-0.66). Utilizing the 5 different GROC scores based on participant perception as anchors, estimated CIDs ranged from 0.29-0.40 (AUC 0.61-0.66). Distribution based methods indicate that the MDC of the AMAT is between 0.40-0.44.

Conclusions: For individuals with stroke, a change ≥0.44 on the AMAT may indicate a likely clinically important improvement in functional movements of the upper extremity.

Clinical Relevance: Clinicians and researchers can utilize the AMAT to identify a meaningful improvement in the ability of individuals with stroke to complete functional movements of the upper extremities. Clinicians can also use this information to formulate meaningful and appropriate goals.
TITLE: Relationship of Functional Reach Test scores to falls in Special Olympics athletes

AUTHORS/INSTITUTIONS: J. Thomas, S. O'Neal, K.E. Varnado, Physical Therapy, Midwestern University, Glendale, Arizona, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The Functional Reach Test (FRT) assesses the maximal distance an individual can reach beyond arm's length without loss of balance. It is a validated measure of balance in adults 21 years and older and in children without disabilities ages 3 to 15 year. There is limited data on its use on children with disabilities. Special Olympics (SO) provides FUNFitness (FF) physical therapy screenings at state games, which includes the FRT. Elements of the FF screening, such as grip strength and physical fitness, have been investigated, however FRT data has not been fully examined to this date. A recent study showed that approximately 50% of SO athletes fell below critical reach values, therefore indicating fall risk. The purpose of this study was to determine if a relationship exists between FRT scores and actual falls.

Number of Subjects: 263

Materials/Methods: Special Olympics athletes completed the FF screenings during the Fall 2016 and Summer 2017 games. Each athlete completed two trials of the FRT (one for each upper extremity). Each athlete was asked if they had a fall within the last year. The FRT and falls data were recorded on a data sheet using a unique participant number. The average age of the SO athletes was 25.72 years (range = 8 to 68 years). A two-tailed Kendall Tau test (α=.05) was utilized to determine relationships between falls and FRT scores.

Results: Data analysis revealed no relationship between number of falls and FRT scores of the left upper extremity (n=263, τ=-.063, p=.202), which was not significant. No relationship was also found between number of falls and the right upper extremity (n=263, τ=-.107, p=.030), which was significant.

Conclusions: The FRT is used routinely as part of the SO FUNFitness screening program; when SO athletes’ FRT scores fall below 20 centimeters, athletes are educated on balance activities. In this study, the number of falls reported per year served as an evidence-based way to assess functional balance in this population. However, this study’s results showed no relationship between the number of falls experienced in a year and FRT scores in any age range of athletes. These results indicate that the FRT may not be an effective means of identifying balance deficits in this population. Further studies are needed to determine the relationship between FRT scores and other means of assessing functional balance in SO athletes. Additionally, further studies to establish FRT norms for this population may be beneficial as this does not currently exist.

Clinical Relevance: Balance is commonly assessed during a physical therapy evaluation and the results can guide a therapist on proper interventions and education. It is essential that therapists choose balance measures that accurately capture each individual’s abilities. The results of this study demonstrated that the FRT may not provide an accurate balance assessment for individuals with intellectual disabilities, which could then result in incorrect interventions and education. Further studies may be needed in order to determine the most valid and reliable measures for this population.
TITLE: High level mobility training to foster effective and efficient functional recovery following an acute stroke: a case study

AUTHORS/INSTITUTIONS: E. Gallo, Physical Therapy, NYU Langone Rusk rehabilitation, Brooklyn, New York, UNITED STATES

ABSTRACT BODY: Background & Purpose: Specificity, amount, and intensity are key variables for motor recovery following neurological injury. However providing sufficient task specific practice for multiple behaviors given the limited sessions represents a significant challenge in the delivery of care. Some evidence suggests that less practice of a more complex similar task leads to improvements in a simpler task. Based on this current evidence, developing interventions that combine intensive training with complex tasks may offer an opportunity for effective and efficient intervention. Williams and Schache (W&S) developed a conceptual framework for retraining High Level Mobility (HLM) following traumatic brain injury structured around the hierarchy of mobility skills using the HiMat and biomechanical characteristic of running. The purpose of this case study is to illustrate the feasibility and effectiveness of the implementation of this framework for retraining HLM on an adult with an acute stroke.

Case Description: A 32 year-old man was referred to outpatient physical therapy following an acute stroke. He presented with right hemiparesis. Patient was able to walk outside using an Ankle Foot Orthosis (AFO). He required a handrail to negotiate stairs. He was unable to work. During his biweekly hour long sessions, he was prescribed HLM training following W&S framework. The program consisted of interventions at the impairment level and at the skill acquisition level following the hierarchical ordering of the mobility continuum as established and defined by the HiMat, as well as the running biomechanics. The patient learned pre-running skills (toe walking, walking over obstacles, stairs), running skills (bounding, running) and post running skills (hopping, skipping, agility drills). Intensity of intervention was monitored using Rate of Perceived Exertion (RPE) scale.

Outcomes: Initially, patient's self-selected gait speed (SSGS) was 1.0 m/s, he walked 1220 ft during a 6-minute walk test (6MWT), his HiMat score was 19/54. He was unable to run, hop, skip and perform right single limb stance (RSLS). He regained the ability to run after 5 visits. After 9 visits, his SSGS was 1.5 m/s, he walked 1700ft during 6MWT, his HiMat score was 29/54. He was able to perform RSLS for 5 sec. During each session, he reported high intensity of training (14 to 16 on RPE scale). He also returned to work as a physician and no longer used his AFO.

Discussion: This program enabled the patient to acquire more complex skills than walking such as running, skipping, and hopping. It forced the patient to practice more complex tasks which could have promoted reverse transfer explaining the improvements with his walking and balance. It also offered opportunities for high intensity training, which has shown to foster greater neuroplasticity than lower intensity training. Those results suggest that this program was effective and efficient in fostering functional recovery. Research will be required to further test this program.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: Single session of 5Hz rTMS applied to left DLPFC improved dual-task walking in chronic stroke: a preliminary report

AUTHORS/INSTITUTIONS: H. Goh, Physical Therapy, Texas Woman's University, Dallas, Texas, UNITED STATES| R.L. Vanasse, Physical Therapy, Texas Woman's University, Dallas, Texas, UNITED STATES| K. Palm, Physical Therapy, Texas Woman's University, Dallas, Texas, UNITED STATES| A. Newton, Physical Therapy, Texas Woman's University, Dallas, Texas, UNITED STATES| I. Nyangani, Physical Therapy, Texas Woman's University, Dallas, Texas, UNITED STATES| D. Walker-Batson, Communication sciences and disorders, Texas Woman's University, Denton, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Dual-task walking is often compromised after stroke. Research suggests the dorsal lateral prefrontal cortex (DLPFC) and supplementary motor area (SMA) may be crucial for dual-task walking in humans and could be a potential target for non-invasive brain stimulation such as repetitive transcranial magnetic stimulation (rTMS). The present study aims to examine the efficacy of rTMS applied to different neural loci in improving dual-task gait in individuals post-stroke. Specifically, we tested the hypothesis that when compared to M1, 5Hz rTMS applied to SMA and DLPFC would significantly improve dual-task gait speed in individuals post-stroke.

Number of Subjects: 5

Materials/Methods: 5 participants (3 males and 2 females, aged 44-76 years) with a history of left stroke greater than 6 months performed single and dual-task gait before and after receiving rTMS applied to different cortical areas. Participants attended 3 sessions (7±2 days apart) in which a high frequency rTMS was applied to either left primary motor cortex (M1), SMA or DLPFC. The rTMS protocol was set at 5Hz, 90% of resting motor threshold of the right tibialis anterior muscle. The order of stimulation areas was randomized and counterbalanced among participants. Gait parameters were collected using the GaitRite carpet walkway. Outcome measure included gait speed under single and dual-task conditions. Dual-task cost (DTC) in gait speed was computed as (Speed_{single} - Speed_{dual})/Speed_{single} x 100%. Data were analyzed descriptively in this preliminary report.

Results: All participants showed a significant reduction in gait speed under dual-task condition (p = .03) with an average DTC of 36%. 5Hz rTMS applied to left DLPFC reduced DTC from 40% to 34%; rTMS applied to left SMA, however, increased DTC from 36% to 40%. DTC remained unchanged after rTMS to left M1 (pre = 35%; post = 34%). Subsequent analysis of gait speed under the two conditions revealed that rTMS had little and a mixed effect on single task gait speed. One participant showed a meaningful increase (> 0.1m/s) after rTMS to SMA and DLPFC while another participant demonstrated a meaningful decrease. In contrast, 3 of 5 participants showed a meaningful increase in dual-task gait speed after rTMS to DLPFC.

Conclusions: Results of this preliminary report indicate that single session 5 Hz rTMS administered to the left DLPFC may improve dual-task walking in individuals post-stroke. Further investigation with a large sample size is ongoing.

Clinical Relevance: Increased dual-task cost is associated with increased risk of falls in older individuals and persons with MS. Results of this study suggest that rTMS to DLPFC may be beneficial in reducing dual-task cost in this population.
Measuring Limits of Stability: Evidence of Concurrent and Construct Validity between the Protokinetics Zeno Walkway and the Bertec Force Plate

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Purpose/Hypothesis: Balance deficits underlie a number of conditions commonly treated by physical therapists. Limits of stability (LOS), usually evaluated via force plates, can provide valuable information about balance and associated insufficiencies. A portable instrumented mat used clinically to measure gait characteristics has recently shown potential for the assessment of LOS. The purpose of this study was to examine the concurrent validity between the Bertec Force Plate, an established instrument to measure LOS, and the Protokinetics Zeno Walkway. It was hypothesized that the systems would demonstrate high concurrent validity when measuring LOS.

Number of Subjects: The study included 51 participants (72.5% female; age= 25.5±7.5 years). All subjects were at least 18 years of age, without known disabilities, and able to fully weight bear through both lower extremities.

Materials/Methods: Bertec BalanceCheck Screener force plate and Protokinetics Zeno Walkway were employed to measure LOS. Each participant performed 3 trials in both narrow and natural stances. Once properly positioned on the Bertec or Zeno walkway, participants were instructed to lean as far as possible in the anterior, posterior, rightward, and leftward directions. If participants lost balance, used compensatory measures such as a hip strategy, bent at the hips or trunk, or used arms for balance, the trial was considered a mistrial, and the subject was retested.

Results: Pearson correlation showed high level of agreement between the two systems when measuring anterior-posterior (rnarrow =.878, P = .000; rnatural = .932, P = .000), right-left (rnarrow =.657, P = .000; rnatural = .928, P = .000), and Total LOS (rnarrow = .756, P = .000; rnatural = .936, P = .000) excursions. Significant positive relationships were observed between natural and narrow stance conditions.

Conclusions: High correlation between both systems indicates that the Zeno Walkway is an appropriate device to measure LOS in a healthy population of young adults without known disabilities when the Bertec Force Plate is not available. Current work is underway to evaluate applicability to patient population.

Clinical Relevance: Results lend evidence of instrument interchangeability when measuring LOS. The results demonstrate evidence of concurrent and construct validity in support of the use of Zeno walkway as a measure of LOS. Clinicians needing to assess LOS can use the Protokinetics Zeno Walkway to measure LOS with confidence in the collected data. The results are of particular interest to investigators interested in postural control studies.
TITLE: The use of Heel Lifts for Individuals with Parkinson’s Disease to Improve Postural Stability.

AUTHORS/INSTITUTIONS: J. Hastings, C. Brown, M.J. McNabb, C. Repasky, School of Physical Therapy, University of Puget Sound, Tacoma, Washington, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis: To investigate if accommodating plantar flexion (PF) contractures with heel lifts will change postural alignment, perceived stability, and balance in individuals with Parkinson’s disease (PD) and to investigate the correlation of PF contracture and Falls Efficacy scale (FES) to predict postural instability. We hypothesize that the use of the heel lifts will improve all outcome measures, and that the severity of PF contractures correlates to higher FES scores.

Number of Subjects: Convenience sampling of 32 community-dwelling participants.

Materials/Methods: Before-after trial with no follow-up. Inclusion Criteria: diagnosed with PD, and ability to independently ambulate 20 ft. without assistive devices. Exclusion Criteria: unable to understand English, and any medical comorbidities that impact postural stability. The study received Institutional Review Board approval, and informed consent was obtained from all participants prior to their participation. Outcome measures were assessed at baseline and then reassessed with heel lifts in their shoes. DF ROM was measured at baseline and participants were assigned to a certain height of heel lift based on their PF contracture severity. Outcome measures included FES, numeric analog perceived stability scale, pressure sway map, functional reach test, and sagittal posture photo analysis. Photo analysis was completed by "Image-J" software and provided the following measures: height; horizontal measures from wall to base of nares, external acoustic meatus, acromion, and posterior pelvis; trunk tilt, and head tilt. FES was only assessed at baseline. Statistical analysis was used on SPSS Version 22 software. A paired-t test used to analyze the sagittal posture photo, perceived stability scale, pressure sway mapping, and the FRT. The FES was correlated to the PF contracture of each participant.

Results: Significant findings (p<.05) include increase in height (mean 1.0 cm) an anterior translation of the hips (mean 2.3 cm) and a more upright trunk (mean 1.4 degrees) and head angle (mean 2.6 degrees). The perceived stability increased (mean .8) and functional reach decreased (mean 2.2 cm). No significant changes in sway were found. Correlations (p=.02), (R=0.36-0.50) were found between the higher degrees of PF contracture and higher total FES scores. Additionally, results demonstrated significant correlations between specific FES scale items 8 (p=.012), 14 (p=.046), 15 (p=.018), and 16 (p=.03) . All scale items entailed some aspect of ambulation.

Conclusions: Accommodating PF contractures, in people with PD, using heel lifts can significantly improve perceived stability and upright postural alignment, but also decreases forward reach measures.

Clinical Relevance: While PD is a degenerative neurological condition, there is an orthopedic component to this disease as well. By accommodating the PF contracture, we can improve this population’s upright posture, which can increase their perceived stability, and ultimately decrease their risk of falls.
Title: Timed Up And Go performance moderates the relationship between trailing limb angle and walking speed in stroke survivors

Authors/Institutions: S.M. Morton, Physical Therapy, University of Delaware, Newark, Delaware, United States| H. Hsiao, Physical Therapy and Rehabilitation Sciences, University of Maryland, Baltimore, Maryland, United States| J.E. Galgiani, Biomechanics and Movement Science, University of Delaware, Newark, Delaware, United States| R. Pohlig, Biostatistics Core Facility, University of Delaware, Newark, Delaware, United States| C.C. Alcantara, Physical Therapy, Universidad Federal de Sao Carlos, Sao Carlos, Brazil| J. Higginson, Mechanical Engineering, University of Delaware, Newark, Delaware, United States

Abstract Body:

Purpose/Hypothesis: Slow gait speed is common in people who have had a stroke, and is associated with a higher metabolic cost of walking. Inadequate trailing limb angle (TLA) is related to slow gait speeds and may contribute to reduced propulsion. Increasing TLA is therefore a potential target for rehabilitation to increase walking speed. However, TLA alone fails to account for all the variation in response to gait interventions, suggesting that other factors, such as poor balance, strength or difficulties with changing direction, may diminish the relationship between TLA and speed. Improving our understanding of this would help determine which stroke survivors are most likely to benefit from strategies targeting increasing propulsion to improve gait speed post-stroke. Therefore, we sought to determine if clinical measures of function related to dynamic balance during gait would moderate the relationship between TLA and self-selected walking speed in chronic stroke survivors. We hypothesized that TLA would be more closely related to speed for those with better dynamic balance performance.

Number of Subjects: Thirty-nine subjects with chronic unilateral stroke participated in the study.

Materials/Methods: This was a retrospective analysis of measures collected at a single time point from stroke survivors prior to their participation in an intervention study. Functional balance assessments were performed by a trained physical therapist and included the Functional Gait Analysis, Berg Balance Scale and Timed Up and Go (TUG) tests. The self-reported Activities-Specific Balance Confidence Scale was also recorded. Gait analysis was completed using motion capture while participants walked on a treadmill to calculate average self-selected gait speed and peak paretic TLA. Moderated regression models were used to examine whether any of the functional or self-reported balance measures significantly predicted self-selected walking speed above and beyond TLA.

Results: Of all the measures, only TUG significantly moderated the relationship between TLA and self-selected walking speed, F(3,35)=75.22, p<0.001, AdjR²=0.85; b=-0.002, t=-4.82, p<0.001, Δ R²=0.09. Specifically, those with slow TUG times walked slower regardless of TLA. However, for those with fast TUG times, greater TLA strongly predicted faster gait speed.

Conclusions: Considering TUG performance significantly improves how well TLA predicts self-selected gait speed. Therefore, the TUG test captures aspects of dynamic balance and functional strength that are not measured by other tests and has unique contributions to predict gait speed, above and beyond TLA.

Clinical Relevance: TUG may be useful to guide clinical decision-making about which clients with stroke could benefit from specific interventions to target propulsion in order to improve walking speed. Future work should study how TUG score identifies responders to propulsion-based gait interventions for stroke.
Physical Therapist Led Yoga for Individuals with Huntington’s Disease: A Qualitative Case Study

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Physical Therapy, Bellarmine University, Louisville, Kentucky, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Research and clinical reports describe the safety, feasibility, and acceptability of community-based exercise programs for people with Huntington’s Disease (HD). The value and role of community-based group yoga for individuals with HD has not been investigated. Furthermore, descriptions of yoga programs for neurological populations often lack detailed descriptions of intervention and instructor qualities that yielded the greatest perceived benefits. The purpose of this study is to examine a community-based yoga class, led by a physical therapist, for individuals affected by HD.

Case Description: Qualitative case study methodology was employed and reflected “insider research” (the research team consisted of licensed and student physical therapists, one of whom was a co-founder of the program that integrated the yoga classes, and two researchers regularly participated in yoga). A certified yoga instructor, who was a neurologic residency-trained physical therapist, led the Hatha style yoga classes. There were six participants in the first class of observation and five participants in the second class of observation. Data collection methods included: [1] participant observations with copious field notes of the classes by two observers, [2] semi-structured interviews with the instructor, and [3] structured participant surveys. The data was manually coded and thematically analyzed by the researchers. Strategies to ensure rigor included field engagement, triangulation, member checks, an audit trail, and reflexivity.

Outcomes: Five major themes emerged regarding the value of the program and the role of yoga for individuals affected by HD. The five themes with descriptive details in parentheses are: [1] Emphasis on mindfulness (through meditation and attention to breath), [2] Yoga is modifiable and accessible (for all levels of participants), [3] Precise communication (including demonstration, purposeful tone, and specific cues to best direct the participants), [4] Yoga fosters a sense of community (an avenue for socialization was provided through the community-based program), and [5] Poses tailored to HD-specific deficits (aim to improve posture, flexibility, range of motion, balance, and awareness of breath).

Discussion: These findings contribute to the growing body of work about community-based group exercise for those affected by HD. The “insider research” approach enabled the richness and depth of participant observations and analysis. Yoga led by a physical therapist can be tailored to enable participation by those affected by HD and to address HD-specific deficits. Yoga is a form of exercise that can be suggested to patients to promote overall wellness and a sense of community as a supplement to, or following, traditional physical therapy. Future research is needed to examine effects of types of yoga, the optimal intensity and duration needed, and outcomes regarding impairments, activity limitations, and participation restrictions.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


The effects of a theory-based intervention on health-related and objectively-measured sedentary behavior and physical activity outcomes after stroke

V. Ezeugwu, P.J. Manns, Physical Therapy, University of Alberta, Edmonton, Alberta, CANADA

Purpose/Hypothesis:
People with stroke (PwS) spend about 80% of their day in sedentary behaviors.\(^1\)-\(^3\) There is mounting evidence for the independent detrimental health effects of prolonged sedentary behavior.\(^4\) The purpose of the study was to test the effects of a sedentary behavior intervention on health-related and objectively-measured sedentary behavior and physical activity outcomes after inpatient stroke rehabilitation.

Number of Subjects: 34

Materials/Methods:
PwS aged 18 years and above, within 1 month of discharge from inpatient rehabilitation, and able to walk at least 5 metres were recruited. Outcomes (time spent sedentary, standing, and stepping, number of steps and sit-to-stands) were measured at baseline (week 0) and post-intervention (week 9). Sedentary and non-sedentary behaviors were recorded for 7 days at each time point using activPAL activity monitor, validated in PwS.\(^5\), \(^6\) Impairment level (Chedoke-McMaster Stroke Assessment), cognitive status (Montreal Cognitive Assessment), walking speed and balance (timed-up and go test) were assessed.

For the intervention, following baseline activity monitoring, action plans (such as standing and walking every half-hour) targeting areas of high sedentary behavior were developed. A wrist-worn Misfit Flash activity monitor, a motivational tool, was used to track adherence to the intervention. Pre – post change in outcomes were examined using paired t-test.

Results:
Thirty-three PwS had complete data at post-intervention. From baseline to post-intervention: Daily average of sedentary time during waking period decreased by 57.5±91.9 minutes (p <0.01). However, waking period also decreased by 39.13±86.69 minutes (p=0.014). When adjusted for waking time, the percentage of sedentary time decreased by 3.3% from 74.9 to 71.6% (p=0.013). Standing time increased by 12.01±44.03 minutes, stepping time 1.24±26.63 minutes, number of steps 359±1736, while number of sit-to-stand transitions decreased by 1.6±11.9 (p>0.05). The impairment level improved from a median of 6 to 7 [IQR: 6-7] for the leg but did not change for the foot (median 6 [IQR: 5-7]), walking speed increased from 0.67±0.26 to 0.87±0.13 m/s, timed-up and go decreased from 18.72±10.68 to 14.95±9.07secs, while cognitive score increased from 24.58±4.68 to 25.91±3.66 (all p<0.01).

Conclusions:
Sedentary time, impairment level, walking speed, balance, and cognition were improved following the intervention. However, these improvements did not translate into significant gains in stepping time or number of steps in PwS.

Clinical Relevance:
Sedentary behavior is prevalent after stroke. In the general population,\(^7\) and people with disability,\(^8\) sedentary behavior is negatively associated with cardiometabolic markers, regardless of exercise levels. Identifying and implementing appropriate strategies to reduce prolonged sedentary behavior after stroke is important. This study provides valuable information related to feasibility of this type of intervention and will inform future sedentary behaviour works with individuals with stroke.
TITLE: The Effectiveness of Wii™-Based Therapy with Improving Balance and Activities of Daily Living Function in Patients Post-Cerebral Vascular Accident: A Systematic Review

AUTHORS/INSTITUTIONS: K. Metzger, C. Walker, S. Barker, J.C. Dittmer, S. Hurley, Physical Therapy, Misericordia University, Dallas, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: In the United States, a leading cause of long-term disability is cerebral vascular accidents (CVAs). A new approach to post-CVA treatment is the use of the Wii™ console. The purpose of this review was to summarize current literature on the use of the Wii™ console post-CVA and analyze its effectiveness in improving balance and ADL function in these individuals while considering how Physical Therapists (PTs) may use the Wii™ as an alternative therapy approach to treat post-CVA patients with balance and ADL dysfunction.

Number of Subjects: N/A

Materials/Methods: EBSCO databases and PEDro database were searched through January 2017. Search terms used were stroke and Wii™. Inclusion criteria included publications between 2010-2017, experimental design studies, stroke patients, and the Wii™ system. Exclusion criteria included systematic reviews without meta-analyses, gaming systems other than the Wii™, and disorders other than stroke. The article quality was evaluated based on the LOER and PEDro scales.

Results: Nine articles were identified through our electronic searches. There were 137 articles omitted based on title, abstract, and exclusion criteria. PEDro scale scores ranged from 4/10 to 8/10. Eight articles were scored a 1b on the LOER scale and one article was scored a 3b.

Conclusions: Based on this review of literature, evidence is supporting the use of Wii™-based therapy in improving balance and ADL deficits in patients post-CVA. The current research does not show that Wii™-based therapy is more effective than conventional, but it does show it is an effective, comparable treatment method. When looking at the conclusions of the articles, implementation of Wii™-based therapy in conjunction with conventional post-CVA rehab is shown to benefit the patient.

Clinical Relevance: Research suggests that PTs have an important role in utilizing these new intervention strategies, such as Wii™, for patients post CVA. However, future research is necessary to identify and understand the specific impact the Wii™ has on balance and ADLs in patients post-CVA as compared to conventional therapy.
TITLE: The Effect of Balance-Based Torso-Weighting and BalanceWear Therapy on Gait, Balance, and Participation in individuals with Vestibular Dysfunction: A Case Series

AUTHORS/INSTITUTIONS: C. Durborow, Outpatient Physical Therapy, Bryn Mawr Rehabilitation Hospital, Coatesville, Pennsylvania, UNITED STATES

ABSTRACT BODY:

**Purpose/Hypothesis**: Individuals with vestibular dysfunction have a 12-fold increase in the reported rate of falls. Vestibular therapy can reduce the risk and burden of falls and fall related injuries, and improve quality of life. Balance-based torso-weighting (BBTW) and BalanceWear Therapy (BWT) have improved function for other populations with balance disorders. The purpose of this retrospective case series is to explore the effects of BBTW and BWT on gait and balance dysfunction, fall risk and participation in individuals with vestibular dysfunction.

**Number of Subjects**: 8

**Materials/Methods**: Four individuals who attended outpatient vestibular physical therapy and utilized BBTW and BWT during their treatment were retrospectively matched with four individuals of the same diagnosis who did not utilize BBTW and BWT. The diagnoses for the 8 cases included BPPV, concussion, dizziness/imbalance, and vertigo. The individuals ranged from 63-86 years old, and included 6 females and 2 males. All patients received traditional vestibular therapy, following standards of care. Four patients also utilized BBTW and BWT in the course of their care. The following outcome measures were compared: Sensory Organization Test (SOT), Functional Gait Assessment (FGA), gait speed (SSV), and the Activities-specific Balance Confidence Scale (ABC). Length of stay in months, and number of total visits were also examined.

**Results**: The BWT group average baseline scores were SOT=55, FGA=16.5, gait speed=2.11 ft/sec, and ABC=64.16%. The control group average baseline scores were SOT= 57.5, FGA=16.5, gait speed=3.02 ft/sec, and ABC= 66.76%. Statistically significant gains were made for all functional tests (t-test SOT: p=0.003, FGA: p=0.0266, gait speed: p=0.030, ABC: p=0.008) from baseline to DC for the BWT group compared to that of control group (paired t-test p<0.05). The BWT group also demonstrated improvements greater than the minimal clinically important difference (MCID) from baseline to post-vest assessment for the SOT, FGA, gait speed and ABC. While the control group made gains in these areas, they were not statistically significant, or greater than the MCID. Length of stay was not significantly different in months (BWT=2.38, standard deviation=1.80; control=2.5, standard deviation=1.29) or number of visits (BWT=14.25 standard deviation=5.74; control=16.00, standard deviation=5.23).

**Conclusions**: This case series examined the use of BWT with individuals with vestibular dysfunction, and demonstrates that BWT may be a viable option to decrease risk of falls and to improve balance, gait, confidence and participation in individuals with vestibular dysfunction. Prospective, blinded studies with randomization and larger sample sizes would be pertinent in future studies.

**Clinical Relevance**: In efforts to decrease the risk and incidence of falls, PTs should consider all available tools. Utilizing BWT allowed these individuals to demonstrate normalized gait, and improved sensory organization to return to a functional level no longer at risk for falls.
Purpose/Hypothesis: (1) To assess the effects of aging on balance and gait velocity in the advanced elderly (90-99 years of age) or nonagenarians, and (2) to determine whether an Alter-G anti-gravity treadmill provides an appropriate aerobic training option for the advanced elderly.

Number of Subjects: Long term care facility participants (n=2): a 92 year old male (92 y/o), and a 90 year old (90 y/o) female.

Materials/Methods: Participants passed a cognition assessment and were medically cleared by their physician before consenting. Self-assessments were collected for each participant on the Modified Gait Efficacy Scale (MGES), Duke Activity Status Index, and the Par-Q. Baseline measurements included systolic blood pressure, heart rate (HR), and oxygen saturation levels (SaO2), the Two-Minute Walk Test, a 10 Meter Walk Test (both at a self-selected pace and fast pace), and postural stability measurements via the Biodex® Biosway platform. Training sessions were twice a week for 10 weeks (92 y/o) and 12 weeks (90 y/o) for a 10 minute supervised walking session on the Alter-G anti-gravity treadmill, using 60% of their body weight at the participant’s self-selected pace. HR, SaO2, and rate of perceived exertion (RPE) were recorded every 2 minutes. Participants increased their speed if their RPE and vitals did not contradict doing so. Distance and speed were recorded at the end of each training session. Subsequent training sessions began at the last recorded speed, or as comfortable to the participant.

Results: The two standard deviation band method of analysis was used to determine statistically significant changes from the baseline phase through the carryover phase. Neither participant’s postural stability changed significantly (Sway Indexes from 1.5 to 0.9), the 92 y/o showed significant change in the 10 meter walk test at a self-selected speed (from 10.5 to 8.25 seconds), and both participants showed significant change in the 10 meter walk test fast pace (92 y/o from 4.5 to 3.3 and 90 y/o from 8 to 6.5 sec.) and as well as two minute walk distance (92 y/o from 70 to 145 meters, and the 90 y/o from 59 to 88). These positive changes were maintained when re-measured after the two-week carryover. In addition, both participant’s MGES scores decreased after completing the training period, although not significantly.

Conclusions: The findings suggest that Alter-G treadmill ambulation is a safe and practical method of exercise for the advanced elderly that can be successfully used to increase gait speed, endurance, and distance. Further research is needed to generalize our findings to a larger population and explore the long-term impact training in this type of environment has on the body.

Clinical Relevance: Falls in the advanced elderly correlate with increased disability, costs, and mortality. Gait speed and balance have been shown to correlate with fall risk in the advanced elderly population. The pilot study demonstrates promise in benefits that may reduce the risk for falls. Further research is needed to establish normative training protocol data for this population.
BACKWARDS WALKING AS AN INTERVENTION FOR AN INDIVIDUAL WITH AN INCOMPLETE SPINAL CORD INJURY AND CANCER

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ABSTRACT

Background & Purpose: After an incomplete spinal cord injury (ISCI) patients often face gait impairments, decreased endurance, impaired balance and decreased lower extremity strength. Backwards walking is an emerging rehabilitation approach that has been reported to address these limitations. However, it has not been studied extensively in patients with ISCI. Furthermore, little is known about backwards walking in patients with comorbidities, such as cancer, in addition to ISCI. This case report describes the effect of backwards walking training on balance, gait and endurance in an individual with ISCI and concomitant cancer diagnosis.

Case Description: The patient was a 68 year old male with colon cancer and subsequent ISCI (C7, ASIA D) after a fall. The patient began outpatient physical therapy 12 weeks post ISCI. During the first 9 outpatient physical therapy visits the patient performed supine exercises and forward ambulation in the parallel bars. Significant foot slap was noted and the patient was fitted for a posterior leaf AFO. After receiving the posterior leaf AFO the patient completed 8 additional (45 minute) sessions over the course of 4 weeks. Treatment consisted of 30 minutes of backwards walking training and 15 minutes of conventional therapy. Backwards walking began in the parallel bars with bilateral hand-rail support, contact guard assist (CGA) and was progressed throughout the sessions to no hand-rail with only hand held assist.

Outcomes: Outcome measures were assessed before and after the 8 sessions of backwards walking training, and included the Berg Balance Scale (BBS), Activities-Specific Balance Confidence (ABC) Scale, 10 Meter Walk Test (10MWT), Timed Up and Go (TUG) and a backwards walking speed assessment. The patient showed improvement in all outcome measures. Increases in the BBS (initial: 25/56, post: 35/56) and the 10MWT (initial 0.53 m/sec, post: 0.72 m/sec) were found to be greater than established minimal detectable change values.

Discussion: ISCI often results in impaired gait and function, and having additional medical comorbidities, such as cancer, affects patient prognosis and may increase fall risk. Backwards walking is a unique approach to normalizing gait and, as part of his plan of care, was shown to improve static balance and gait speed in this patient. Backwards walking requires greater reliance on proprioception, neuromuscular control and protective reflexes due to the elimination of visual cues. It also requires increased muscle activation and has greater metabolic demands. These additional challenges contributed to this patient’s clinically significant gains in static balance and gait speed, improving his function and, more importantly, reducing his fall risk. This case suggests that backwards walking should be considered as a treatment option when working with patients post ISCI alone or post ISCI with co-morbidities such as cancer.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Background & Purpose: The most severe manifestations of West Nile virus (WNV) include encephalitis and paralysis due to injury of the anterior horn cells, which result in lifelong and significant neurologic sequelae. Previous studies have shown that inpatient rehabilitation can improve outcomes in people with paralysis after WNV infection. Although intensive locomotor training (LT) has been shown to improve outcomes for people with incomplete spinal cord injuries, its effects on individuals with WNV have not yet been studied. This case study illustrates the potential benefits of LT for an individual with chronic paraplegia secondary to WNV (three years post-infection) who showed clinically meaningful improvements in walking and balance abilities.

Case Description: This 67-year-old female developed encephalitis and myelitis with paralysis after acute WNV infection in 2013. Her cognitive impairment fully recovered, but her paraplegia remained after receiving standard rehabilitative care in a tertiary hospital. The participant began LT two years post-discharge from inpatient rehabilitation. Her goals were to stand and walk with an assistive device and transfer independently. The LT program included body-weight supported treadmill training (BWSTT) and over-ground training (OGT). The participant attended 57 training sessions with mid-point assessments. Over the course of BWSTT, treadmill speed increased from 0.45m/s to 0.63m/s and the amount of manual assistance decreased, but BWS remained unchanged. The OGT included walking, balance, strength, and transfer training.

Outcomes: The participant showed improvement in walking and balance abilities as measured by the Berg Balance Scale (pre-intervention score: 15, post-intervention score: 32), 10 Meter Walk Test (0m/s, 2.9m/s), Six Minute Walk Test (0m, 110.1m) and the Activities Specific Balance Confidence (ABC) scale (23.8%, 50%). At three months follow-up, these gains were either maintained or further improved, except for the ABC scale (40%). Post-intervention, a semi-structured interview was completed to capture her perceptions of the LT’s impact. Three themes emerged: 1) Recalibrating goals; 2) Outcomes (i.e. physical and psychological benefits, including a sense of accomplishment and planning for the future); and 3) The challenges of LT and effective coping strategies.

Discussion: This case study presents the outcomes of LT for a woman with paraplegia after WNV infection. The timing and types of interventions provided were unique compared to previous studies. The participant, who was initially non-ambulatory, was able to walk independently with a walker by the end of training. She demonstrated improved walking and balance abilities, while reporting increased function and independence at home. Her self-reported balance confidence improved and she enjoyed the LT program. Through this case study we determined that intensive LT is both feasible and tolerable for someone with WNV, and improved outcomes can be seen past the subacute stage of the disease.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Harkema SJ, Schmidt-Read M, Behrman AL, Bratta A, Sisto SA, Edgerton VR. Establishing the NeuroRecovery Network: multisite rehabilitation centers that provide activity-based therapies and assessments for neurologic disorders. Archives of physical medicine and rehabilitation. 2012 Sep 30;93(9):1498-507.


Title: Does Task-Evoked Pupillary Response Reflect Change in Postural Control? A Proof-of-Concept Study

Authors/Institutions: M. Kahya, A. Akinwuntan, K. Williams, H. Devos, Physical Therapy and Rehabilitation Science, University of Kansas, Kansas City, Kansas, United States

Abstract Body:

Purpose/Hypothesis: Most activities of daily living require dual-tasking. Upright stance posture is an essential motor skill to accomplish various motor and cognitive tasks concurrently. Task-evoked pupillary response (TEPR) has been used as a neurophysiological measure of cognitive effort during cognitive tasks. The purpose of this study was to establish the proof-of-concept that TEPR can also be used to evaluate cognitive effort during postural control in single and dual-task conditions.

Number of Subjects: Seven healthy young adults [Age: 30±6.3; Sex: 6 male/1 female; Years of education: 16.7±3.5] were recruited to this ongoing study.

Materials/Methods: All subjects were tested at the University of Kansas Medical Center. Subjects were asked to wear eyetracking glasses (iViewETG 2.0, SensoMotoric Instruments, Germany) in order to record the TEPR across four conditions: (1) single postural control task with eyes open; (2) single postural control task with eyes occluded; (3) dual task condition with eyes open; (4) dual task condition with eyes occluded. During the single postural control task, subjects were asked to stand on the balance platform (AMTI OPT464508-1000, Advanced Mechanical Technology, Inc., Watertown, MA, USA) for 30 seconds with eyes open and eyes occluded. The dual task with eyes open involved patients standing on the balance platform while performing the auditory stroop test. This test was repeated with eyes occluded. The cognitive effort, indexed by TEPR, was transformed on a continuous scale ranging from 0 to 1, was the main outcome variable. The center of pressure (CoP) displacement was the secondary outcome variable. One-way repeated measures Analysis of Variance (ANOVA) was employed to compare TEPR and CoP displacement across the four conditions.

Results: TEPR significantly increased with increased complexity of tasks (p=.003). Post-hoc analyses showed that TEPR significantly increased from condition #1 (.35±.03) to condition #4 (.52±0.3); (p=.02). By contrast, no differences were found in CoP in x axis (p=.572) and CoP in y axis (p=.485) displacements.

Conclusions: Our preliminary data show that TEPR can potentially be used to evaluate cognitive effort during single and challenging postural control tasks in real time. This neurophysiological response is perhaps even more sensitive than traditional measures of postural control during dual-tasking. This study will build a foundation to implement the TEPR in the balance assessment methods of older adults with and without neurological conditions.

Clinical Relevance: TEPR may potentially be used as a real-time and objective neurophysiological tool for dual-task postural control. Future studies are warranted to investigate whether this neurophysiological response may predict postural balance impairments of older adults and patients with neurological conditions before they emerge in balance tests.
TITLE: The relationship between BDNF Val66Met polymorphism and functional recovery in chronic stroke survivors

AUTHORS/INSTITUTIONS: D. Reisman, University of Delaware, Newark, Delaware, UNITED STATES|M.A. French, Department of Physical Therapy, University of Delaware, Newark, Delaware, UNITED STATES|R. Pohlig, Biostatistics Core Facility, University of Delaware, Newark, Delaware, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: A common single nucleotide polymorphism, Val\textsuperscript{66}Met, in the Brain Derived Neurotrophic Factor (BDNF) gene has been studied for its role in neuroplasticity, cognition, depression, and recovery following stroke. In the first 3 months following stroke, Val\textsuperscript{66}Met has been associated with poorer overall recovery; however, no research has examined the role the Val\textsuperscript{66}Met polymorphism may play in the long-term recovery of mobility after stroke. Additionally, current models have not accounted for factors that have been suggested to alter the impact of the Val\textsuperscript{66}Met polymorphism (i.e., gender, age, and depression). Thus, the purpose of this study was to examine the relationship between BDNF genotype and functional mobility in chronic stroke survivors by examining a model that first accounts for factors known to be related to the Val\textsuperscript{66}Met polymorphism.

Number of Subjects: 56 subjects who had a stroke more than 6 months earlier.

Materials/Methods: Participants completed the Yesavage Geriatric Depression Scale (YGDS), 10 meter walk test (SSWS), and DNA testing for BDNF genotype. A regression model was used to determine if including the genotype (Val or Met) increased model fit in predicting functional recovery, as measured by SSWS after accounting for demographic information (age, gender, and YGDS).

Results: Knowing an individual’s age, gender, and YGDS score did not significantly predict SSWS ($R^2 = 0.117$, $p=0.088$). The addition of the genotype did not significantly increase the variance accounted for in SSWS ($\Delta R^2 = 0.009$, $p=0.463$).

Conclusions: Our results suggest that for those greater than 6 months post stroke, the presence of the Val\textsuperscript{66}Met polymorphism does not predict functional recovery. This is in contrast to past research, which found that within the first 3 months after a stroke, knowledge of BDNF genotype provided significant information about functional recovery. This difference may be due to the functional nature of our outcome measure (i.e., SSWS) compared to more impairment based measures that have been used in previous studies (i.e., modified Rankin score and Fugl Meyer). Additionally, the acute impact of the Val\textsuperscript{66}Met polymorphism may be greater than the effect seen in those with chronic stroke due to the increasing influence of other factors, such as self-efficacy, physical activity, and development of comorbid conditions, on mobility recovery.

Clinical Relevance: In contrast to previous findings within 3 months post-stroke, our results suggest that the presence of the BDNF Val\textsuperscript{66}Met genotype does not predict longer-term mobility recovery.
Purpose/Hypothesis: The purpose of this systematic review was to synthesize the evidence for the use of virtual reality treadmill training (VRTT) on balance and gait in adults with chronic stroke.

Number of Subjects: 269

Materials/Methods: Six reviewers searched six databases (PEDro, PubMed, ScienceDirect, Proquest, Cochrane, and CINAHL), selecting all articles that met the selection criteria. Article quality was appraised through the use of the PEDro Scale by random assignment to four reviewers. Data pertaining to each study’s methodology, participation information, outcome measures, and results were extracted. To increase homogeneity, articles evaluating similar outcome measures were pooled. Effect sizes were calculated using Cohen’s d in order to determine clinical significance.

Results: A total of 11 articles met the selection criteria. The studies consisted of seven randomized control trials, three pilot randomized control trials, and one within group pretest-posttest design. The median score on the PEDro Scale for all articles was seven. All six studies that measured the effects of VRTT on dynamic balance found statistical improvements, with effect sizes ranging from 0.78 to 3.51. One of the three studies that measured static balance found statistical improvement in some aspects of sway. Four articles evaluated the effects of VRTT on balance confidence and two of these studies found statistical improvements, with effect sizes ranging from 1.07 to 1.11. Of the five articles that measured spatiotemporal parameters, four studies found statistical significance, with a range of effect sizes from 0.38 to 2.87. Out of the three studies that measured ambulation distance, two studies found statistical differences. Seven of the eight articles that measured gait speed found statistical improvements, with a range of effect sizes from 0.19 to 1.54 and lastly, two studies measured its effect on functional gait ability and found statistical improvements, with an effect size of 1.03 for one of those studies. Dual-task training contributed to a greater effect than single-task training for spatiotemporal parameters.

Conclusions: There is moderate to strong evidence supporting the effectiveness of VRTT for improving dynamic balance, balance confidence and gait in individuals following chronic stroke. There is some evidence indicating there are no effects on static balance. VRTT can be used in addition to conventional physical therapy in order to maximize an individual’s recovery post-stroke.

Clinical Relevance: This systematic review shows that use of VRTT can improve certain aspects of balance and gait following chronic stroke. VRTT uses the motor learning principles of task-oriented practice, repetition, and variability. It is recommended that VRTT sessions should be completed at least 30 minutes per day, three times per week, for four weeks with use of a safety harness. Dual-task training is also recommended in order to provide a more real-life environment.
TITLE: Endurance Exercise Improves Function in Individuals with Parkinson’s Disease: a Meta-analysis

AUTHORS/INSTITUTIONS: A. Flach, Physical Therapy and Athletic Training, Saint Louis University, St. Louis, Missouri, UNITED STATES|L. Jaegers, S. Ahmad, Occupational Science & Occupational Therapy, Saint Louis University, St. Louis, Missouri, UNITED STATES|M. Krieger, Medical Center Library, Saint Louis University, St. Louis, Missouri, UNITED STATES|E.A. Bixler, Department of Environmental and Occupational Health, Department of Biosecurity, College for Public Health and Social Justice, Saint Louis University, St. Louis, Missouri, UNITED STATES|P.V. Kelly, Saint Louis University, St. Louis, Missouri, UNITED STATES|E. Weiss, Department of Nutrition and Dietetics, Saint Louis University, St. Louis, Missouri, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Current evidence has shown that exercise can reduce symptoms of Parkinson’s disease (PD). However, previous studies indicated mixed results, possibly because of variability in the nature of the exercise interventions. The purpose of this study was to perform a meta-analysis of current evidence from endurance exercise intervention studies for effects on the United Parkinson’s Disease Rating Scale (UPDRS) in individuals with PD.

Number of Subjects: 7

Materials/Methods: A systematic literature search in six electronic databases was performed and two independent reviewers screened the title and abstract of 1,106 records captured by the initial search. Inclusion criteria for full-text review were (A) peer-reviewed English-language publications, (B) randomized controlled trials that compared an aerobic exercise intervention group to a non-exercising control group, and (C) an outcome measure which included the UPDRS total score or section III (motor) subscore. From the title/abstract screening, the same independent reviewers assessed 245 full-text articles for eligibility. Of the full-text articles reviewed 7 articles were included in our meta-analysis, 238 were excluded for the following reasons: 147 did not meet our endurance exercise criteria, 53 were review/systematic reviews, 34 were conference abstracts or posters, 2 were editorial or commentary, 1 was a study protocol, and 1 was unpublished.

Our measure of endurance exercise training was defined by the American College of Sports Medicine (ACSM) guidelines. Accordingly, the exercise mode had to be continuous and rhythmic, and require a substantial amount of the body's muscle mass to be active; examples include walking and cycling. Exercise duration was required to be ≥20 minutes per session and frequency of exercise had to be ≥3 sessions per week. Exercise intensity had to be "moderate" or "vigorous," defined as ≥46% of maximal exercise oxygen uptake (VO2 max), ≥46% of maximal exercise metabolic equivalents (MET max), or ≥64% of maximal heart rate (HR max).

Results: The d index was used to calculate the difference between means of different groups within individual studies, and a weighting factor or w was used to calculate the effect size across studies. Overall, d index was found to be -0.32 with 95% confidence interval, CI (-.09, -.56) which is statistically significant indicating a positive effect of endurance exercise in UPDRS scores.

Conclusions: In conclusion, this meta-analysis supports integrating endurance exercise training, as defined by ACSM, into treatment of PD.

Clinical Relevance: While previous meta-analyses have included a focus on the effects of endurance exercise in PD, there were varied definitions of endurance exercise that were used to determine inclusion of studies and none included the level of specificity, including frequency, intensity, time and type that was defined in this current meta-analysis. Therefore, this meta-analysis provides support for the positive effect of endurance exercise on PD using more clearly defined minimum dosing parameters.
TITLE: Margin of Stability and the Functional Gait Assessment in Spinal Cord Injury


ABSTRACT BODY:

Purpose/Hypothesis: Our purpose was to determine if clinical measures of balance are correlated with biomechanical mechanisms of gait stability in individuals who have an incomplete spinal cord injury (iSCI). Specifically, we explored the relationship between a laboratory measure, lateral margin of stability (MoS), and a clinical measure, the Functional Gait Assessment (FGA). Increasing MoS is a passive strategy that can be utilized to increase medial-lateral stability. This may be desirable for individuals with iSCI because it reduces the requirements to make active corrective responses to balance perturbations. We hypothesized; 1) a negative correlation between MoS during forward walking and FGA scores, and 2) FGA scores would have stronger negative correlations with MoS during fast walking than self-selected walking.

Number of Subjects: 9 individuals with chronic iSCI (ASIA Impairment Scale C, D), 1 non-impaired individual.

Materials/Methods: The following clinical measures, FGA, lower extremity motor scores from the International Standards of the Neurological Classification of Spinal Cord Injury, Walking Index for Spinal Cord Injury, and Ten Meter Walk Test, were assessed for each subject. Trunk, pelvis and lower-limb kinematics were recorded as subjects completed 20 over ground walking trials at self-selected and fast velocity. This data was used to calculate minimum MoS for each step.

Results: The mean MoS across all subjects was 0.10 ± 0.02m. The MoS for a non-impaired subject was 0.08m. The correlation between mean MoS and FGA was r = -0.18. Correlations between mean MoS and FGA self-selected and fast walking were r = -0.14 and r = -0.28, respectively.

Conclusions: Individuals with iSCI have a higher MoS as compared to a non-impaired individual. There were weak correlations between MoS and FGA in subjects with iSCI. Caution should be used when interpreting MoS in isolation as it may not relate to established clinical measures of functional balance. Although correlation of MoS and FGA improved during fast walking, the relationship was still weak.

Clinical Relevance: Although increasing MoS can passively improve balance abilities, this strategy was not consistently demonstrated. Increasing MoS may require strength and motor control abilities that are not accessible to all individuals with iSCI. Rather, individuals may utilize a variety of different strategies to compensate for impaired balance. MoS and FGA in isolation provide different perspectives on functional balance and adopted balance strategies. Clinicians may estimate MoS by observing base of support. This estimation can be used in conjunction with functional measures for a physical therapist’s clinical reasoning related to balance and fall risk.
TITLE: The Effect of Augmented Reality Visual Cues on Temporal-Distance Gait Parameters in Individuals with Parkinson's Disease: A Systematic Review

AUTHORS/INSTITUTIONS: W. Connell, A. Crowley, C. Fitzgerald, S. Marri, R.M. Hakim, Physical Therapy, University of Scranton, Scranton, PA, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this systematic review was to determine if augmented reality visual cueing (ARVC) improves temporal-distance gait parameters (TDGP) in individuals with Parkinson’s Disease (PD).

Number of Subjects: N/A

Materials/Methods: A literature search (2007-2017) of PubMed, CINAHL, Google Scholar, and ProQuest was conducted using search terms: (Augmented reality OR wearable computing OR wearable gait aid OR assistive technology OR visual gait cue*) AND Parkinson's Disease AND (Physical therapy OR physiotherapy OR Rehab*) NOT Auditory Feedback. Search limits: English, human subjects, peer-reviewed. Selection criteria: adults diagnosed with PD, intervention included ARVC during gait (defined as virtual visual cues projected into the environment/visual field to enhance gait) and outcomes included TDGP. Two reviewers independently assessed each study for methodological quality and came to consensus using Sackett Levels of Evidence.

Results: A total of 960 articles were screened for eligibility. After detailed appraisals, 8 studies met the selection criteria. Sackett Levels ranged from 2B-3B. Sample size ranged from 7-26 subjects (130 total). Subjects with PD (120) ranged from age 53-85 (H&Y stages I-IV). Treatment parameters ranged from 1 session to 2 wks (60 min/day) in clinical settings (4 studies during "on" meds, 2 "off", 2 both). Primary TDGP outcomes included: gait speed, cadence, stride length. There were statistically significant gait speed improvements in 7 of 8 studies (2B-3B): average gain of 14.68% (avg. pre-post range, 0.79-0.85 m/s). Four of 8 studies (3B) had statistically significant cadence improvements (average change of 8.82%; 99.23-103.12 steps/min). Four of 8 studies (2B-3B) had statistically significant stride length improvement (average gain of 13.55%; 81.28-88.90 cm). Positive user reviews included self-reported gait improvement (4 of 8 studies) and lasting improvement after device removal (1 of 8). Negative user reviews included technophobia (1 of 8) and bulkiness of the device (2 of 8). Secondary outcomes also included statistically significant improvements in freezing of gait, UPDRS scores, and TUG times while wearing device.

Conclusions: There is low to moderate strength preliminary evidence (Grade C) in support of ARVC to improve TDGP in individuals with PD. Binocular, transparent smart glasses (Epson) appeared most effective in improving TDGP. Limitations included small samples, widely varied devices and training parameters, lack of control groups and long-term follow up. Future research should determine optimal training protocols using ARVC with long term follow-up. Clinical Relevance: Many ARVC devices are readily available and relatively inexpensive. Clinicians should consider ARVC technology when recommending assistive devices for patients with PD to promote immediate benefits in TDGP (exceeding gait speed MDC values of 0.18-0.25 m/sec; Steffen & Seney, 2008). ARVC may also provide positive effects after device removal, including improvements in FOG, UPDRS scores, and TUG times.
TITLE: The Effectiveness of Transcranial Direct Stimulation on Gait in Persons with Parkinson’s Disease: A Systematic Review

AUTHORS/INSTITUTIONS: B. Esterle, L.E. Fluehr, C. Liberatore, M. McEnroe, R.M. Hakim, Physical Therapy, University of Scranton, Scranton, PA, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study was to determine the effectiveness of transcranial direct current stimulation (tDCS) on gait in persons with Parkinson’s Disease (PD).

Number of Subjects: N/A

Materials/Methods: A literature search of Proquest Central, MEDLINE/PubMed, CINAHL, and Cochrane Library was conducted using search terms: (Parkinson* OR PD) AND (Transcranial direct current stimulation OR tDCS OR tDC) AND (Gait OR mobility OR ambulation OR gait velocity) NOT (transcranial magnetic stimulation OR TMS). Search limits: English, human subjects, peer-reviewed, RCTs. Selection criteria: adults with PD, intervention included tDCS, and an outcome measure of temporal-distance and/or complex gait. Two reviewers independently assessed studies for methodological quality and came to a consensus based on PEDro guidelines.

Results: A total of 52 articles were screened for eligibility. Following detailed appraisals, 7 RCTs met the selection criteria. PEDro scores ranged from 7 to 10 (mean=9.14). Samples ranged from 10-25 subjects (128 total) with mild to moderate PD (H&Y I-IV; age range 40-80 yrs). Treatment parameters included 2 mA of tDCS applied to various brain areas (anterior to central zone or left dorsolateral prefrontal cortex) for treatment times ranging from 13 to 20 min (during “on” phase), 3Xweek, for 2.5-4 weeks. Five studies applied tDCS at rest, while 4 studies applied tDCS with gait training. Primary outcomes included: 10 m Walk Test, 6 min Walk Test, Timed Up and Go (TUG, TUGcog), Dynamic Gait Index (DGI). 2 studies showed statistically significant improvements in gait speed (+0.19 m/s) when combining tDCS with gait training or dual task conditions. 2 studies showed statistically significant improvements in TUG scores (-1.24 s) following tDCS combined with gait training. 1 study showed statistically significant improvements in TUG (29.18 +/- 24.17 to 24.35 +/- 18.97) and DGI (13.88 +/- 8.31 to 16.18 +/- 7.48) scores when evaluating gait immediately post-tDCS. Secondary outcomes that showed statistically significant improvements included cadence, bradykinesia, BBS, stride length and QOL. No adverse events were reported requiring drop-out.

Conclusions: There is moderate evidence (6 RCTs) to support the effectiveness of tDCS on improving gait in patients with PD. When combined with gait training, patients receiving tDCS showed accelerated and long-term effects of treatment compared to those receiving gait training alone. Limitations included small sample sizes, lack of follow-up on long-term effects, and treatment during “on” phases only. Further research is needed to determine optimal training parameters with long-term follow-up.

Clinical Relevance: Overall, there were greater improvements in gait when combining gait training with tDCS in patients with PD. All studies concluded that tDCS was a safe and feasible intervention to use when managing patients with PD. Based on resources and availability, clinicians should consider combining non-invasive tDCS with gait training for patients with mild to moderate PD in a rehab setting.
TITLE: The Impact of Community-Based Rehabilitation Programs on Adults with Traumatic Brain Injury: A Systematic Review


ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this systematic review was to determine the impact of Community-Based Rehabilitation (CBR) programs on adults following traumatic brain injury (TBI).

Number of Subjects: N/A


Results: A total of 301 articles were screened for eligibility. Following detailed appraisals, 6 research articles met the criteria. MINORS scores for comparative studies ranged from 19 to 23/24 (avg. 21/24) and 2 non-comparative studies scored 13/16. Sample sizes ranged from 20 to 81 participants (total= 293) with mild to severe TBI (age range =18-65; avg. 40.5). CBR programs included: Tai Chi, cognitive rehabilitation, group-based psychoeducation, in-home psychosocial and functional training, life skills, goal setting, and individualized programs focused on physical fitness, accessibility and psychosocial adjustment. Health care providers included: cognitive therapist, (neuro)psychologist, and an interdisciplinary team. Treatment parameters varied widely from 1-3x/week for 1-3 hours/session, with durations ranging from 8 weeks to 2 years. Two studies reported statistically significant improvements in community reintegration and participation. There were trends toward improvement that did not reach statistical significance for outcomes including: patient competency, mood, perceived self-efficacy, emotional adjustment, functional ability, and quality/satisfaction with life.

Conclusions: There is moderate evidence supporting CBR programs to improve community reintegration and participation for individuals with TBI. Limitations included widely varied outcome measures and treatment parameters, heterogeneous patient groups, and small sample sizes. Future research should assess the most optimal mode of delivery, training parameters based on severity level, and standardized outcome measures for CBR.

Clinical Relevance: The diagnosis of TBI is commonly characterized by chronic psychosocial dysfunction, including loss of independent living skills, relationship breakdown, and social isolation. Clinicians should consider referring patients with TBI to participate in CBR following completion of typical outpatient services. CBR programs offer a variety of treatment options for both individual and group-centered development. CBR may be most beneficial for individuals with TBI who display decreased psychosocial functioning because of the socialization and focus on reintegration.
Purpose/Hypothesis: Traumatic brain injury (TBI) is prevalent in Kentucky and comes with a high cost in care and quality of life. We hypothesized that people with TBI living in rural Kentucky faced challenges specific to their rural setting. The purpose of this study was to 1) explore the lived experiences of people with TBI and caregivers in rural regions of Kentucky across the continuum of care and 2) increase understanding of supports and barriers they experienced related to optimal function and well-being.

Number of Subjects: 13 participants with TBI, 6 caregivers

Materials/Methods: A qualitative descriptive interview study was conducted by a multidisciplinary team. The interview consisted of open ended questions with iterative questioning and probes to increase validity. Field notes and reflective memos were used to increase clarity. Interviews were recorded and transcribed verbatim. Content analysis was completed with data-derived coding and iterative modifications to analysis, coalescing codes into categories and themes. Intercoder agreement and member checking increased reliability.

Results: Categories were the levels of care across the continuum (emergency, acute, inpatient rehabilitation, outpatient, home). Medical care provided in emergency and inpatient settings was perceived as very good at saving lives, but lacking in adequate communication and education. Inpatient rehabilitation was perceived as excellent in providing therapies to increase patient competence, but caregivers faced many barriers. Integration into the rural community was the most challenging transition for people with TBI and caregivers. Many impairments remained, rehospitalization was common, and there existed a lack of linkages to community resources. The main themes that emerged were related to aspects of Self Determination Theory: Autonomy, competence, and relationship.

Conclusions: Unmet needs were most pervasive for people when returning to their underserved rural communities. Communication across care locations was lacking. Unmet needs for caregivers existed across the continuum. We propose trained community health navigators ally with patients and caregivers early in the process of TBI, and provide the linkages and education necessary to reduce barriers and facilitate transitions across the continuum of care.

Clinical Relevance: Rehabilitation for people with TBI is essential to supporting the development of competence and autonomy. Relationships with caregivers sustain people with TBI, but caregivers from rural areas face many unmet needs across the continuum. People with TBI face substantial barriers when returning to their rural communities in terms of accessing needed resources, including rehabilitation. Therapists should focus efforts to improve communication across the continuum of care and develop strategies to intentionally link patients/caregivers with needed resources as they reintegrate into rural communities.
Outpatient Physical Therapy in a Woman who is a Manifesting Carrier of Duchenne's Muscular Dystrophy Gene

D. Lotan, Physical Therapy - Outpatient Adult, New York University Rusk Rehab, New York, New York, UNITED STATES

Background & Purpose: Muscular dystrophies cause progressive weakness due to an inherited genetic defect (1). In Duchenne's (DMD), mutations occur in an X-linked gene affecting dystrophin, a protein crucial for muscles. Carriers of the DMD gene are women with 1 normal dystrophin gene on 1 X-chromosome and another mutant gene. A manifesting carrier has random inactivation of 1 X-chromosome (2), causing cycles of degeneration and regeneration in muscles. Manifesting carriers make up 10% of female DMD carriers (3). They present with weakness, pain and fatigue, with 3-84% of female carriers with cardiomyopathy (4). Nonspecific regular exercise is advised (5) but the role of exercise interventions is inconclusive (6). There is a lack of research on physical therapy (PT) management. The purpose of this case study is to highlight the PT course in a DMD manifesting carrier.

Case Description: A 42-year-old female, a manifesting carrier of the DMD gene, was referred to outpatient PT with a diagnosis of weakness and imbalance. Patient's (Pt) complaints were falls, fatigue, right knee buckling, difficulty negotiating stairs/inclines, and inability to participate in high intensity step classes. She presented with LE weakness, high steppage gait, and right LE foot slap with fatigue. PT interventions included LE progressive resistance and balance exercises, stair/curb negotiation, and endurance training with target heart rate (HR) of 40-60% of age-predicted maximum HR and a Rating of Perceived Exertion (RPE) scale goal of 9-12, as well as energy conservation techniques.

Outcomes: During the initial examination, the following outcome measures were performed: 5X Sit to Stand Test (FTSTS): 15 sec, Functional Gait Assessment (FGA): 28/30, Six Minute Walk Test (6MWT): 440 meters, Habitual gait speed: 1.3 m/sec, and Activities Specific Balance Confidence scale (ABC) Scale: 89%. Pt was independent (IND) with functional tasks with increased time. She was able to reciprocally ascend and descend 1 flight of stairs with unilateral handrail (U/L HR) IND in 7 sec each. Right ankle plantarflexor (PF) strength was a grade 3. At discharge, outcomes were as follows: FTSTS: 12 sec, FGA: 27/30, 6MWT: 500 meters, and Habitual gait speed: 1.3 m/sec; No right foot drop; 6 sec to reciprocally ascend 1 flight of stairs without handrails IND, and descend reciprocally in 4 sec. Ankle PF strength was a grade 4. ABC scale: 91%. The Pt. reported no falls, and was able to return to her step class with IND monitoring of her HR/RPE. There were no adverse effects from PT.

Discussion: Individuals who are manifesting carriers of DMD can benefit from PT intervention. This case study details PT interventions to manage the neuromuscular, musculoskeletal, and cardiovascular impairments in a DMD manifesting carrier. The exercises allowed her to make some gains in outcome measures and meet her goals. The lack of evidence to guide exercise prescription needs to be further explored to improve the utility and determine the effectiveness of PT in the management of these patients.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: A Model for Active Dissemination and Implementation of Clinical Practice Guidelines Published by Academies and Sections of the APTA

AUTHORS/INSTITUTIONS: K. Skop, Dept of Veteran Affairs, Tampa, Florida, UNITED STATES| E. Dannenbaum, Vestibular Rehabilitation, Jewish Rehabilitation Hospital, Laval, Quebec, CANADA| S. MacDowell, Hearing and Balance Center, Our Lady of the Lake, Baton Rouge, Louisiana, UNITED STATES| L.J. D'Silva, Physical Therapy and Rehabilitation Science, University of Kansas Medical Center, Kansas City, Kansas, UNITED STATES| J.K. Tilson, University of Southern California, Los Angeles, California, UNITED STATES| B.E. Crowner, Program in Physical Therapy, Washington University, St. Louis, Missouri, UNITED STATES| L. Farrell, Symmetry Alliance, LLC, Fort Lauderdale, Florida, UNITED STATES| H.R. Roth, Northwestern University Feinberg School of Medicine, Shirley Ryan Ability Lab, Chicago, Illinois, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: American Physical Therapy Association (APTA) academies and sections have published 14 clinical practice guidelines (CPGs) in the past 10 years. Strategies for CPG dissemination have been predominantly passive (e.g. journal and web publication). Models are needed to facilitate active dissemination and implementation of APTA academy/section-generated CPGs. The purpose of this report is to describe a process established by a taskforce of the Academy of Neurologic Physical Therapy (ANPT) of the APTA to disseminate and promote implementation an ANPT-published CPG.

Number of Subjects: N/A

Materials/Methods: A call for volunteers to join a Dissemination and Implementation Taskforce was sent to organization members two months prior to publication of the target CPG. A seven-member volunteer taskforce was selected and charged to disseminate the CPG and promote its implementation. None of the members were authors of the original CPG, all were active practitioners in the CPG focus area (vestibular disorders), and one had an academic focus in implementation science. Three members, new to implementation science, attended a 2-day knowledge translation workshop to broaden the groups’ expertise.

Results: The taskforce developed a three-phase plan: 1) Rapid, wide-spread dissemination to promote awareness of the CPG among primary intended users (specialty practice physical therapists and physicians); 2) A multi-site implementation study at the taskforce members’ institutions; and 3) Sustained, wide-spread dissemination of products developed and lessons learned from the implementation phase.

Phase 1 resulted in development of at-a-glance CPG summaries for key stakeholders and a decision aide for physical therapists. The documents were distributed in mass at targeted professional conferences, online, and via social media. Phase 2 resulted in a five-site implementation study of the target CPG based on the Consolidated Framework for Implementation Research and the Knowledge to Action Cycle. Results presented will include how the Consolidated Framework and Knowledge to Action Cycle influenced the process of selecting and tailoring the implementation intervention and ongoing results of implementation efforts. The impact of emerging Phase 2 results on Phase 3 plans will also be presented.

Conclusions: Dissemination and implementation of APTA academy/section CPGs may be effective through a 3-phase, sequential process that includes: 1) broad dissemination for awareness; 2) taskforce member-initiated efforts to implement the CPG at their local institutions; and 3) sustained, wide-spread dissemination of lessons and products from the implementation efforts in Phase 2 that can be adapted for local use.

Clinical Relevance: Our model provides a systematic process by which APTA academies and sections can build their capacity to disseminate and promote implementation of CPGs. A taskforce, separate from the CPG development team, composed of expert clinicians and individuals with expertise in implementation science is recommended.
TITLE: Monitoring exercise-induced ectopic beat frequency using high resolution wearable sensing: A safety study during high intensity gait training (HIIT) in individuals with stroke

AUTHORS/INSTITUTIONS: A. Jayaraman, Physical Therapy & PM&R, Shirley Ryan AbilityLab/ Northwestern University, Chicago, Illinois, UNITED STATES|K. Hohl, C. Jayaraman, K. Mummidisetty, S. Kaur, Shirley Ryan AbilityLab, Chicago, Illinois, UNITED STATES|N. LeDeaux, Feinberg School of Medicine, Northwestern University, Chicago, Illinois, UNITED STATES|

ABSTRACT BODY:
Background & Purpose: A common exercise prescription for post-stroke rehabilitation is treadmill based gait training at higher intensities (up to 70-80% heart rate reserve (HRR)) in conjunction with over-ground walking training. Safety precautions followed during training are predominantly adopted from guidelines in cardiovascular literature. In this study, we focus on one such guideline, the frequency of exercise induced premature ventricular ectopic (PVC) during post-exercise rest used to assess the safety of an exercise protocol. Evidence suggests that frequent exercise induced PVC’s during post-exercise recovery (5-10 min) is associated with increased risk of death. Based on literature, >7 ventricular beats/min are suggested as serious indicator of risk to cardiovascular health. However, this has not been well studied in individuals with stroke during recovery. Given the significant implications for safety during increasingly intensive training programs, the main aim of this case series is to investigate the occurrence of PVC’s during quiet sitting as well as exercise induced PVC’s during and after a hybrid HIIT exercise protocol and 6 Min Walk Test (6MWT; surrogate to over-ground walking) in a group of individuals with chronic stroke.

Case Description: 9 stroke subjects (57.2 yrs, ischemic= 5) participated in the study. Participants were categorized into impairment level based on gait speed from the 10 Meter Walk Test. Each performed 2 min sitting & 6 MWT with 2 min recovery. 2 subjects (62 yrs, ischemic & mild=1, hemorrhagic & severe=1) performed a HITT protocol with 8 min seated recovery. A validated high resolution wearable body conforming sensor, BioStampRC, was used to collect continuous EKG data during all tests to measure PVCs.

Outcomes: The frequency of PVCs were counted manually by a qualified evaluator blinded to the outcomes. Subjects with severe gait impairment had frequent occurrence of PVC’s during the 2 min quiet sitting [Severe:10(SD=4.6); mild: 2.4(0.9); F=10.79, p<0.05] & during the 6MWT [Severe: 15.75(7.1); mild: 4.2(3) p<0.05]. In the 2 min recovery, PVC counts were [severe: 11.75(1.5); mild: 2.25(0.5)].

For the HIIT there was 8-26 PVCs during training for both subjects. In the seated recovery, the PVCs were averaged in 2 min blocks up to 8 min yielding 4 bins of PVC counts [severe: 9,9,9,15 mild: 6,13,8,21].

Discussion: This case series showed that (1) level of gait impairment may be related to frequency of PVC’s during quiet sitting and 6 MWT and (2) exercise induced PVC’s exceeded the safety threshold during exercise and in recovery period for 6MWT & HIIT protocol. These observations suggest that implementing novel high resolution EKG monitoring during & after exercise in the clinic could be beneficial for rehabilitation practice. Further research is required to understand the implications of frequent PVCs during HIIT training to make sure our training strategies are safe and efficacious.


TITLE: Test-retest reliability of gait speed in people post stroke who require physical assistance and assistive devices to walk.

AUTHORS/INSTITUTIONS: G. Fulk, K.C. Olds, Y. He, Physical Therapy, Clarkson University, Potsdam, New York, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Purpose of this study was to determine the test re-test reliability of comfortable gait speed (GS) in people 5-30 days post stroke who did and did not require physical assistance (PA) and/or an assistive device to walk. We hypothesized that the test re-test reliability would be high (ICC$_{2,1}$ >=0.90) across all categories of participants, but that it would be lower in those that did not require PA to walk and in those that did not require an assistive device compared to those that required PA to walk and those that required an assistive device.

Number of Subjects: A total of 289 participants between 5 and 30 days post stroke; 219 required PA to walk, 70 could walk without PA, 267 used an assistive device, and 22 did not use an assistive device.

Materials/Methods: GS was measured twice in one session over a 10m walk. The amount of PA required by each participant to walk was categorized using the Functional Ambulation Categories (FAC). We analyzed test-retest reliability using the following methods: ICC$_{2,1}$, Minimal Detectable Change at a 90% confidence level (MDC), and the Bland Altman mean difference (BAMD) and 95% limits of agreement. We calculated these statistical indices for the following groups of participants: 1) all participants, 2) those that required PA to walk (FAC<4), 3) those that did not require PA to walk (FAC>3), 4) those that required an assistive device to walk, and 5) those that did not require an assistive device to walk, 6) those that required PA to walk and used a less supportive assistive device (straight cane or quad cane), 7) those that did not require PA to walk and used a less supportive assistive device (straight cane or quad cane), 8) those that required PA to walk and used a more supportive assistive device (hemi walker, two wheeled walker, standard walker), and 9) those that did not require PA to walk and used a more supportive assistive device (hemi walker, two wheeled walker, standard walker).

Results: Mean gait speed ranged from 0.33 m/s (participants who did not require PA to walk) to 0.22 m/s (participants who required PA to walk and used a less supportive assistive device). Depending on need for PA and assistive device ICC$_{2,1}$ ranged from 0.97 to 0.94, the mean difference between trial 1 and trial 2 ranged from -0.01 to -0.04 m/s, and the MDC ranged from 0.06 to 0.09 m/s.

Conclusions: Our study found that GS measured over a 10m walk demonstrates strong test-retest reliability in patients that do or do not require PA and in patients who do or do not use an assistive device early after stroke. Our hypothesis was partially correct.

Clinical Relevance: GS is reliable early after stroke. The MDC (0.06-0.09 m/s) values estimated here can assist clinicians and researchers with interpreting change in GS in people 5-30 days after stroke.
TITLE: Using the CanPain SCI Clinical Practice Guidelines to Address Neuropathic Pain after Spinal Cord Infarct to Dramatically Improve Mobility

AUTHORS/INSTITUTIONS: S. Kleinstein, T. Cheng, Rehabilitation, NYU Langone Medical Center, Brooklyn, New York, UNITED STATES

ABSTRACT BODY:
Background & Purpose: Persistent pain is a common but challenging sequela of spinal cord injury (SCI). Up to 80% of patients with SCI complain of significant pain, which can negatively impact their physical, psychological and social functioning, and reduce capacity to participate in physical therapy (PT). Poorly managed pain during the first year of SCI can become a lifelong condition. Because different types of pain require different treatment approaches, accurate diagnosis is imperative. The purpose of this case study is to highlight the CanPain SCI Clinical Practice Guidelines for Rehabilitation Management of Neuropathic Pain after Spinal Cord Injury and its use in addressing neuropathic pain (NP).

Case Description: The patient is a 50-year old female presenting to outpatient PT two months after a non-traumatic SCI at T12/L1. While classified as an Asia C at the conclusion of her 3-week stay in acute rehabilitation, she had only been able to minimally ambulate with a body weight supported harness system following her injury. While pain free at the start of treatment, the patient had severe hip/knee flexion contractures from prolonged sedentariness. The patient’s goal was to walk.

Outcomes: After several weeks of PT, the patient began taking independent steps with a rolling walker. However progress came to an abrupt halt as the patient developed intense unremitting pain of 8/10 in her lower legs and feet. This pain significantly affected her ability to participate in PT, and mobility regressed to a status of dependent. Initially believed to be a side effect of ambulation, it soon became evident the pain, described as “pressure,” was unchanged by movement or positioning, was not related to inflammation, and disrupted her sleep. Interestingly, the affected area was greater than three levels below the original neurological injury, months after that injury had occurred. According to the CanPain SCI Clinical Practice Guidelines, this is a prototypical example of “typical below-level neuropathic pain,” a category of NP that responds well to medical management. The patient was referred back to her physician who began the patient on Gabapentin, a first line of therapy for the treatment of NP associated with SCI. Although there is no gold standard for diagnosing NP, using a classification system enhances detection which can facilitate treatment. With the combination of successful medical management, PT, and the patient’s commitment to recovery, the patient reduced her hip/knee flexion contractures, increased her strength, and began walking household distances.

Discussion: SCI is often a devastating diagnosis, and the presence of NP can curtail ambulation goals in even the most motivated patients. The results of this case report suggest that when PTs understand the CanPain SCI Clinical Practice Guidelines, they are better able to refer patients for appropriate medical management. In turn, this can advance mobility in patients who may otherwise be non-ambulatory secondary to pain.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: The Impact of Type 2 Diabetes on mobility deficits measured by the Functional Gait Assessment in Individuals with Benign Paroxysmal Positional Vertigo

AUTHORS/INSTITUTIONS: L.J. D'Silva, Physical Therapy Education, Rockhurst University, Kansas City, Missouri, UNITED STATES| P. Kluding, Physical Therapy and Rehab Sciences, University of Kansas Medical Center, Overland Park, Kansas, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Type 2 Diabetes (T2D) has been shown to affect vestibular function and the prevalence of benign paroxysmal positional vertigo (BPPV) is higher in people with diabetes. Another common complication of T2D is the development of diabetic peripheral neuropathy (DPN). The combination of these factors can impair balance and mobility and decreasing functional mobility. The Functional Gait Assessment (FGA) is an outcome measure that examines various aspects of mobility required for daily function. In this cross-sectional study, we compared performance on the 10-items of the FGA between healthy controls with and without neuropathy and individuals with BPPV and T2D (BPPV+DM) with and without neuropathy.

Number of Subjects: Thirty-two participants, controls (n=16) and BPPV+DM (n=16) with a confirmed diagnosis of unilateral posterior canal BPPV canalithiasis completed the study. Patients with neurological diagnoses and musculoskeletal problems that could affect mobility were excluded.

Materials/Methods: The 10-item FGA was completed in people with BPPV+DM when they were symptomatic with BPPV and was compared to healthy controls. All subjects were examined for peripheral neuropathy using the Michigan Neuropathy Screening Instrument (MNSI), and were categorized as having neuropathy if their physical exam score was ≥ 2. Total score on the FGA between groups was compared using ANOVA with Tukey’s test for post-hoc comparisons. Kruskal-Wallis tests were used to compare difference in performance on each item of the FGA between the 4 groups.

Results: No baseline differences were present between groups in age (mean age 60.6 ± 7.6 years) (p=0.6) or sex (p=1.0). Peripheral neuropathy was seen in 2 subjects in the control group (12%) and 7 subjects in the BPPV+DM group (43%). Significant differences in total FGA score were seen between people with BPPV+DM and DPN (19.1 ± 4.0) when compared to healthy controls (27.9 ± 2.0) (p<0.001), controls with neuropathy (28.5 ± 0.7) (p=0.009), and people with BPPV+DM (24.1 ± 4.7) (p=0.03). The most difficult task on the FGA for people with BPPV+DM and DPN to perform when compared to people with BPPV+DM was walking with a narrow base (p=0.03). When people with BPPV+DM+DPN were compared to controls with peripheral neuropathy, level walking (p=0.02) and walking with eyes closed (p=0.03) showed lower scores. Item scores on 8 of the 10 items on the FGA were significantly higher in controls compared to those with BPPV+DM+DPN except for change in gait speed and pivot turns.

Conclusions: In people with BPPV+DM and DPN, performance of mobility tasks required for daily function are significantly impaired when compared to healthy age matched people. In the presence of DPN, walking with decreased proprioceptive and visual feedback were further compromised.

Clinical Relevance: In people with BPPV, diabetes and diabetic peripheral neuropathy, everyday movements are significantly impaired. Education regarding potential for falls in the symptomatic stage of BPPV is necessary.
ABSTRACT BODY:

**Purpose**: Integrated care pathways (ICPs) are pathways that aim to have ‘the right people, do the right things, in the right order, at the right time, in the right place, with the right outcome.’ As one of the leading causes of disability in the United States, ICPs for stroke have been developed to improve timeliness of intervention and utilization of the multidisciplinary team. Research suggests that ICPs during the acute management of stroke are beneficial. However, in the rehabilitation setting, few ICPs exist to improve the utilization of the multidisciplinary rehabilitation team or standardize outcome measures and evidence based interventions. It is difficult to demonstrate value of rehabilitation intervention without first standardizing outcome measures. Therapists generally have used their expertise and experience to determine the best way to measure changes. However, continuity is lacking among physical therapists. The purpose of this article is to describe the process of developing and implementing standardized outcome measures for the stroke population across all disciplines in the Johns Hopkins Hospital Outpatient clinics.

**Description**: Outcome measures either highly recommended or recommended by the Stroke EDGE document for performance in the outpatient setting were initially considered. The determining factors of the outcome measures included the measurement construct, reliability and validity of the measure, the simplicity and ease of use, and the efficiency or the length of time to administer. Staff were educated on the development, purpose, and protocol for the measures. Regular audits were performed to ensure clinician adherence and accuracy of completion.

**Summary of Use**: Outcome measures were standardized across physical therapy, occupational therapy, and speech therapy. Both the measures and their protocols were standardized to ensure consistency between therapists. The physical therapy outcomes chosen were the timed up and go (TUG), the five time sit to stand (5xSTS), the two-minute walk test (2MWT), the ten meter walk test (10MWT), the stroke impact scale-16 (SIS-16), and the Activity Measure for Post-Acute Care - Basic Mobility (AMPAC). These measures are taken at evaluation, every 30 days or 10 visits whichever came first, and at discharge.

**Importance to Members**: With ongoing changes in reimbursement, it is increasingly important that rehabilitation professionals provide objective data supporting our role through the use of outcome measures. While patients after stroke can have highly variable presentations, we believe these measures capture the most relevant and necessary constructs of activity (balance, endurance, strength, and mobility) and participation. Further efforts will be made to ensure adherence to outcome measure standardization and meaningful measurement of change to optimize intervention for this population.
TITLE: Impact of External vs Internal Focus of Attention Strategies on Seated Lateral Excursion Measures in Adults with Chronic Stroke and Healthy Adults

AUTHORS/INSTITUTIONS: A. Hyatt, S.L. McPherson, V.I. Franco, H.D. Bowen, R.J. Foil, E.N. Kao, T.A. Linton, Physical Therapy, Western Carolina University, Cullowhee, North Carolina, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: External focus of attention instructions provided during functional task training may enhance performance and learning of adults post stroke. Recently, mean lateral excursion performance of adults post stroke (1-2 months) was greater for external focus (EF) instructions rather than internal focus (IF) instructions during a seated balance task. This randomized trial extended this work via a motor learning paradigm that included healthy adults (HA) and adults with chronic stroke (CS).

Number of Subjects: 12 CS (mean age 61.4 ± 13.8 years; 6 months to 13 years post-unilateral stroke), with good trunk control (Function in Sitting Test [FIST] mean score 51 ± 2.9/56) were randomly assigned to receive IF or EF instructions during seated balance training. Exclusion criteria was severe hemineglect (Star Cancellation Test <44/54) or inability to follow multistep commands. 12 HA were matched on gender, age (+ 3 years), and IF or EF instruction.

Materials/Methods: Testing included baseline, acquisition, short term retention (5 minutes later), and long term retention (7 days later) phases. 3 trials of seated weight shifting were performed per side per phase per adult. Following baseline, adults viewed a video demonstrating proper weight-shifting technique. During acquisition IF was told to shift their body weight towards their right (or left) hip. EF had targets at shoulder height and arm length and were told to move their shoulder as close to the target as possible. Adults during other phases were told to shift their body weight towards their right or left. Lateral excursion of center of pressure was measured via pressure mat. Separate 2 (IF/EF) x 4 (phases) ANOVAs were conducted on mean lateral excursion scores for CS per side (affected/unaffected) and for HA per side (right/left).

Results: In CS, no significant main or interaction effects (P>.05) occurred. In HA, EF showed significantly greater lateral excursion than IF. Movement to left side showed significant effects for IF/EF (P=.011, η²=.495), phases (P=.036, η²=.24), and interaction (P=.05, η²=.226)[VF1]. Also, movement to right side produced significant main effects for IF/EF (P=.029, η²=.394) and phases (P=.003, η²=.362) only.

Conclusions: EF instructional cues showed greater lateral excursion during a seated balance task compared to IF instructional cues in HA but not in CS. These findings differ from previous findings in adults with acute stroke. We caution, quality of form and adherence to instructions may provide further insight into these findings.

Clinical Relevance: Impact of instructional cues on automatic control processes and/or working memory load were not evident in these adults with chronic stroke for this task. However, EF instructions compared to IF instructions produced greater task performance and learning for these healthy adults. The role of instructional cues requires further study for this specific task and remains unresolved for clinicians to date.
TITLE: 'OPTIMAL' practice conditions enhance the benefits of increasing error opportunities on retention of a stepping sequence task

AUTHORS/INSTITUTIONS: D. Levac, K. Driscoll, J. R. Galvez, K. Mercado, L. O'Neil, Physical Therapy, Movement and Rehabilitation Sciences, Northeastern University, Boston, Massachusetts, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Errorful and errorless practice conditions can enhance motor skill learning in different populations and tasks. Errorful learning provides opportunities for learners to make choices. Enhancing learner autonomy through choice opportunities is a key component of the Optimizing Performance through Intrinsic Motivation and Attention for Learning (OPTIMAL) theory of motor learning. The objective of this study was to evaluate the interaction between error opportunity frequency and OPTIMAL (autonomy-supportive) practice conditions during stepping sequence acquisition in a virtual environment.

Number of Subjects: 40

Materials/Methods: Young adults were randomized to autonomy-supportive or autonomy-controlling conditions, which differed in instructional language, focus of attention (external vs internal) and positive versus negative nature of visual and auditory feedback. All participants practiced 40 trials of 4, six-step stepping sequences in a random order. Each sequence offered differing choice opportunities via visual cue presentation (4 choices; 1 choice; gradually increasing [1-2-3-4] choices, and gradually decreasing [4-3-2-1] choices). Participants completed the Intrinsic Motivation Inventory (IMI) and the User Engagement Scale (UES). Participants returned 1-3 days later for retention tests, where learning was measured by time to complete each sequence. No cues were offered on retention.

Results: Participants in the autonomy-supportive group outperformed the autonomy-controlling group at retention on all sequences (mean difference 2.88s, p < 0.005, t(6835) = 3.42). Participants in both groups had the most difficulty acquiring the decreasing choice (4-3-2-1) sequence (p < 0.001, t(6835) = -4.26) and performed most poorly on the errorful (4 choice) sequence (p<0.034, t(6835) = 2.65) at retention. Participants in the autonomy-supportive group performed best at retention on the increasing choice (1-2-3-4) sequence (p < 0.033, t(6835) = -2.7). Participants in both groups who reported greater attention to the task on the UES Average Focused Attention subscale had poorer retention performance, particularly for the decreasing choice (4-3-2-1) sequence (p < 0.005, t(6835) = 3.39). Participants in the autonomy-supportive group reported significantly higher Interest/Enjoyment (p < 0.001, t(38) = 3.804, d = 1.22) and Perceived Competence (p < 0.001, t(38) = 3.525, d = 1.15) on the IMI as compared to the autonomy-controlling group.

Conclusions: An interaction effect produced greatest retention for the hybrid increasing choices sequence (1-2-3-4 choices) with OPTIMAL conditions. Autonomy-controlling practice conditions involving negative feedback combined with increased choice/error opportunities during early skill acquisition may impair learning by emphasizing an internal focus of attention.

Clinical Relevance: Findings add to the body of literature supporting the OPTIMAL theory of motor learning by demonstrating that the benefit of these conditions are robust to error/choice opportunities.
TITLE: Central Nervous System Connectivity in a Man with Motor Incomplete Tetraplegia


ABSTRACT BODY:

Purpose/Hypothesis: 1) Examine central nervous system (CNS) structural connectivity using advanced diffusion neuroimaging in a man with spinal cord injury (SCI) compared to normative data, 2) Examine corticospinal tract (CST) connectivity using transcranial magnetic stimulation (TMS).

Number of Subjects: A 32 year old man with chronic incomplete motor tetraplegia (C8 AIS C) without spinal hardware and 10 subjects without neurologic injury participated in the study. The subject with SCI had only volitional left dorsiflexion motion below level of injury (LOI).

Materials/Methods: All subjects underwent cervical spinal cord/brain multishell diffusion acquisition imaging in a 3T magnetic resonance imaging scanner. Diffusion tensor imaging (DTI) and neurite density orientation dispersion imaging (NODDI) examined white matter integrity. The subject with SCI also underwent single pulse TMS testing with a figure of 8 coil and neuronavigation to identify CST integrity for 16 muscles, 6 above and 10 below LOI.

Results: Fractional anisotropy (FA), the most common diffusion index of white matter integrity, was decreased in the subject with SCI (0.25 SCI, 0.47 ± 0.08 non-SCI) indicating loss of white matter and degeneration of spinal tracts. Orientation dispersion index (ODI) was increased showing increased dispersion of fibers in the subject with SCI (0.39 SCI, 0.16 ± 0.10 non-SCI). In several areas of the brain, ODI and FA values showed differences in the subject with SCI compared non-SCI. Using TMS, high stimulus intensity (>80% output) activated thoracolumbar erector spinae and left tibialis anterior (TA) below LOI.

Conclusions: Neuroimaging results based on diffusion demonstrate structural connectivity changes in the spinal cord and brain for the subject with SCI. TMS activation of the TA matched volitional ability as other lower extremity muscles were not activated. While trunk muscle motor function is difficult to assess clinically, TMS results indicate presence of CST connectivity to these muscles. These preliminary results are encouraging and warrant further investigation in a large group of subjects with SCI.

Clinical Relevance: Data from advanced imaging techniques using diffusion acquisition and from TMS testing increase the ability to measure and understand central nervous system changes following SCI. As continued rehabilitation needs are based on functional progress, the potential to add quantitative data on CNS function could allow more targeted intervention and justification for continued rehabilitation. In addition, spared white matter has been shown to be predictive of locomotor recovery in a mouse model, thus suggesting potential for these techniques to have predictive value for humans.
TITLE: Improved Gait and Balance After Speed-Dependent Locomotor Training in an Adult with Chronic Stroke, Human Immunodeficiency Virus and Neurosyphilis

AUTHORS/INSTITUTIONS: S. Dineen, A. Cook, J. Freund, Elon University, Carrboro, North Carolina, UNITED STATES

ABSTRACT BODY:

Background & Purpose: There is mounting evidence to support relationships among human immunodeficiency virus (HIV), antiretroviral therapy (ART), neurosyphilis, and ischemic stroke. Hospital admissions of individuals with stroke and HIV have been increasing. The incidence of individuals with co-infection of HIV and neurosyphilis is also rising. Stroke can be the initial presentation for each of these infections. Researchers have demonstrated positive outcomes in persons with stroke using speed-dependent locomotor training (overground and with body-weight support on a treadmill). There is minimal research on the effects of physical therapy (PT) in persons with stroke and other neurological co-morbidities. The purpose of this case report is to describe the effects of speed-dependent locomotor training in an individual with HIV, neurosyphilis and chronic stroke.

Case Description: The patient was a 26 year old male, one year post right medullary and bilateral basal ganglia infarct. His co-morbidities included HIV, neurosyphilis, and cytomegalovirus, which were diagnosed upon admission for stroke. It was at that point he began ART. After his stroke and prior to this case report he received physical therapy in inpatient rehabilitation, a skilled nursing facility, and an outpatient clinic. For this report he participated in ten one-hour sessions of PT over five weeks as a patient in a university PT course. At initial evaluation, he had spastic tetraplegia, decreased functional mobility, used a wheelchair and required assistance with most activities of daily living. PT intervention primarily concentrated on speed-dependent locomotor training including body-weight supported walking on a treadmill and overground walking. Additional interventions included limited transfer training, dynamic reaching, and one session of aquatic therapy.

Outcomes: After eight intervention sessions the patient demonstrated meaningful improvements in the following outcomes (pre-, post-intervention): Postural Assessment Scale for Stroke (13/36, 25/36), Berg Balance Scale (8/56, 19/56), Box and Blocks right upper extremity (14, 23 blocks), transfers (moderate assistance, minimum assistance), gait (10 ft with maximum assistance x 2, >50 ft with minimum assistance x 1). Subjectively, he reported increased confidence and independence with activities of daily living and functional mobility. His mother also reported decreased burden of care.

Discussion: A young adult one year post severe stroke with HIV and neurosyphilis made meaningful improvements in gait, balance, and transfers following only eight sessions of speed-dependent locomotor training and transfer training. He also made improvements in upper extremity function with minimal upper extremity intervention. As the incidence of stroke with HIV, and neurosyphilis co-morbidities increases, speed-dependent locomotor training should be considered in the rehabilitation of these individuals.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


A Bout of Acute High-Intensity Exercise Alters Corticomotor Excitability Post-Stroke

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Purpose/Hypothesis: In healthy individuals, it has been shown that a brief bout of acute exercise can induce broad plasticity in the brain; i.e., it alters corticomotor excitability in non-exercised muscles\(^1\)–\(^3\). The same type of exercise can also improve motor learning and retention in healthy individuals\(^4\), and the amount of retention is correlated with the amount of change in corticomotor excitability\(^5\). Following stroke, corticomotor excitability of the lesioned hemisphere is decreased, and the decrease is related to poor functional performance after stroke\(^6\)–\(^9\). Acute exercise may therefore be a promising method to induce both increased corticomotor excitability and improved motor learning, but to our knowledge, this has never been tested in people with stroke. Thus, the purpose of the current study was to investigate whether a short bout of high-intensity lower extremity exercise could alter corticomotor excitability in people post-stroke. We hypothesized that corticomotor excitability of non-exercised upper extremity muscles would be increased bilaterally after a bout of acute exercise.

Number of Subjects: Thirteen individuals with chronic, unilateral stroke participated.

Materials/Methods: Subjects participated in two sessions scheduled at least one week apart. In each session, they underwent either high-intensity exercise or quiet rest. During exercise, they walked on a treadmill at 70% - 85% of their age-adjusted maximum heart rate; treadmill speed was adjusted so that subjects exercised at the target intensity. Corticomotor excitability of the extensor carpi radialis muscles was measured bilaterally with transcranial magnetic stimulation (TMS) before and immediately after either exercise or rest. Post-exercise or rest measures were normalized to pre-test measures. Paired t-tests or Wilcoxon signed-ranks tests were used to compare the changes in corticomotor excitability following exercise vs. rest conditions.

Results: All participants were able to reach the target exercise level. Blood lactate levels increased significantly after exercise (\(p < 0.001\)). Resting motor evoked potentials (MEPs) from the lesioned hemisphere increased after exercise compared to the rest condition (\(p = 0.046\)). All other TMS measurements, including active MEPs, contralateral and ipsilateral silent periods, and the same measures from the non-lesioned hemisphere, were not different between exercise and rest conditions.

Conclusions: Our results indicate that a short bout of high-intensity exercise can increase corticomotor excitability in a non-exercised muscle post-stroke. Our hypothesis was only partially confirmed since we only saw significant changes in corticomotor excitability of the lesioned hemisphere.

Clinical Relevance: Given our results, acute exercise shows promise as a potential priming method in stroke rehabilitation, especially given that corticomotor excitability changes were only significant in the lesioned hemisphere. However, the effects of acute exercise on motor learning, and whether they correlate with these neurophysiological changes still need to be investigated.
TITLE: Feasibility and preliminary outcomes of a standardized exercise program in adults with Down syndrome: A pilot study

AUTHORS/INSTITUTIONS: M. Flores, K. Barta, E. Ardolino, G. Ferreira, M. Sneary, Physical Therapy, University of St. Augustine for Health Sciences - Austin, Austin, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Youth with Down Syndrome (DS) have limited participation in physical activity. When compared to their typically developing peers, adults with DS display decreased functional mobility and strength. Exercise has shown to improve the physical fitness, overall health, and quality of life in people with DS. The Lee Silverman Voice Treatment (LSVT® BIG) is an effective treatment approach designed for patients with Parkinson's disease. The core components of LSVT® BIG include large amplitude movements, sensory calibration, high intensity, and maximum effort while performing the daily exercises. Due to hypotonicity associated with DS, these individuals typically display kyphotic posture, shortened step length and overall lower amplitude movements. The LSVT® BIG protocol has the potential to improve muscle tone and overall fitness in adults with DS similar to the improvements seen in the Parkinson's disease population, but the effects have yet to be studied. The purpose of this pilot study was to test the feasibility of implementing a 4 week standardized group exercise program in adults with DS, and assess whether subjects improved after this protocol.

Number of Subjects: A convenience sample of 8 adults with DS were recruited from a residential facility.

Materials/Methods: This exploratory, feasibility pilot study employed a pretest-posttest design. Outcome measures were assessed at baseline and at one week post intervention. The independent variable for this study was the LSVT® BIG standardized exercise protocol. Outcome measures included: the Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) and timed single leg stance (SLS) for balance, the 10 meter walk test (10MWT) for gait speed, the 30 second sit-to-stand test for lower extremity functional strength, and the timed-up-and-go (TUG) for overall functional mobility. Each participant completed the established LSVT® BIG protocol in a group exercise format, totaling 16 sessions.

Results: LSVT® BIG certified instructors were able to lead the group exercises for all 8 adults with DS with no adverse effects. Attendance varied between 10 to 16 sessions, with an average participation rate of 13.75 days (SD = 2.17). Standard LSVT® BIG modifications were easy to implement when needed. There was a statistically significant increase in self-selected gait speed (median self-selected gait speed post-test score, Mdn = 1.01, vs. median pre-test score, Mdn = 0.78, z = 35, p = 0.02). There were no other significant changes in functional strength, balance or fast gait speed, however the median scores improved for all dependent variables except for one of the mCTSIB scores and 30 second sit-to-stand test.

Conclusions: A 4 week high-amplitude standardized exercise program can improve self-selected gait speed in adults with DS, but may not have a statistically significant effect on their balance or functional strength.

Clinical Relevance: The LSVT® BIG standardized exercise protocol can be used for adults with DS in a group exercise setting and may also improve the gait speed for this population.
TITLE: Improved quality of life following constraint-induced movement therapy is associated with extent of arm use, but not motor improvement.

AUTHORS/INSTITUTIONS: A.L. Borstad, Physical Therapy, College of St. Scholastica, Duluth, Minnesota, UNITED STATES|K.M. Kelly, Physical Medicine and Rehabilitation, The Ohio State University, Hilliard, Ohio, UNITED STATES|L.V. Gauthier, Physical Medicine and Rehabilitation, The Ohio State University, Columbus, Ohio, UNITED STATES

ABSTRACT BODY:
Purpose/Hypothesis: The aim of this study is to identify which CI therapy motor-related outcomes most influence quality of life. We hypothesize that improved arm use during daily activities (Motor Activity Log), will be more strongly correlated to improved quality of life (Stroke-specific Quality of Life) than will improvements in objective motor function (Wolf Motor Function Test, Action Research Arm Test).

Number of Subjects: 30

Materials/Methods: Two cohorts of participants with chronic stroke upper extremity hemiparesis received either traditional CI therapy (n=19) or video-game home-based CI therapy (n=11). Stepwise multiple regression analyses were performed on the combined data set to identify the relative contribution of improved motor speed, quality of movement, and daily arm use on quality of life after CI therapy.

Results: The only predictor associated with improved quality of life was the extent of improvement in daily arm use. Improvements in quality of life were not restricted to motor domains, but generalized to psychosocial domains as well.

Conclusions: The current study suggests that the transfer package component of CI Therapy, which promotes daily use of the affected arm during everyday activities, is integral to maximizing quality of life gains during motor rehabilitation for post-stroke upper extremity hemiparesis. In contrast, gains in motor function were not independently associated with improvements in quality of life.

Clinical Relevance: These findings support the need for clinical implementation of therapeutic techniques that emphasize improvement in arm use during daily life activities if enhancing quality of life is a main goal of treatment.
ABSTRACT BODY:

**Purpose/Hypothesis**: 795,000 new or recurrent strokes happen yearly in the US with 6.8 million people suffering long-term stroke-related disability. Short term, 80% of strokes result in hemiparesis and impaired upper extremity (UE) function, with persistent UE deficits in 30% to 66% of survivors. These limitations result in lower self-perceived quality of life, higher anxiety, difficulty with activities of daily living (ADL’s), and reduced social and community participation. Previous research has identified robot therapy (RT) as a solution to deliver the high repetition, individualized therapy that may be needed to enhance neuroplasticity and for optimal rehabilitation. Most research has used end effector (EE) RT devices as they may be lower cost than other RT devices, and has focused on the chronic population. However, research comparing EE RT to conventional therapy (CT) is lacking for people in the subacute (SA) stage post-stroke who have hemiparesis. The purpose of this study is to summarize evidence about whether dose-matched EE RT of the UE is more effective than CT in regaining UE functional use among people with hemiparesis in the SA stage post-stroke.

**Number of Subjects**: 163 participants from 4 RCT’s

**Materials/Methods**: Database searches resulted in ~200 abstracts that were reviewed to identify the most current systematic review and 4 randomized controlled trials (RCT’s) that specifically compared EE RT in the SA population with CT. All 4 RCT’s required intervention dose-matching and used the Fugl-Meyer scale (FM) to measure UE functional outcomes.

**Results**: Four out of 4 RCT’s found that EE RT for the UE was at least as beneficial as CT as measured by the FM. Two out of 4 RCT’s found no significant difference between EE RT compared to CT while 2 RCT’s found significant benefits for EE RT compared to CT (one met the FM MCID). Additionally, 1 study found that EE RT significantly benefitted passive range of motion and spasticity in the shoulder and elbow, contradicting the most current systematic review. Three studies also explored ADL’s finding non-significant benefits of EE RT.

**Conclusions**: The evidence is mixed; EE RT for the UE was at least as beneficial as CT as measured by the FM for people with hemiparesis in the SA stage post-stroke. Findings held even with careful intervention dose-matching and across multiple outcome measures. Interestingly, the studies showing significant benefits of EE RT incorporated video feedback whereas the others did not. Some limitations were that the studies were small (26 to 53 subjects), study durations were short (3 to 5 weeks) and follow up was limited (0 to 7 months). All studies included some CT for both groups, and used different EE and CT interventions.

**Clinical Relevance**: This review of evidence for RT UE suggests that it may be as effective as CT for people in the SA stage post-stroke, at least when measured by the FM. Physical therapists should follow the rapid development of EE RT given its potential for clinical benefit in people at the SA stage post-stroke.
ABSTRACT BODY:

**Purpose/Hypothesis**: The purpose of this study is to identify which participant factors best predict improvement in daily use of a hemiparetic arm after constraint-induced movement therapy (CI therapy). The authors hypothesize that better pre-treatment fine motor ability will be the greatest predictor of improved daily use of a hemiparetic arm with gross motor ability, touch sensation, and cognition also playing a significant role.

**Number of Subjects**: 68

**Materials/Methods**: Affected side and measures of cognition (MoCA), gross motor function (WMFT), fine motor function (WMFT), daily use of the affected arm (MAL), and touch sensation (SWMT) were collected prior to receiving either traditional CI therapy or game-based CI therapy. Daily use of the affected arm was measured again after intervention. These factors were input into an enhanced probabilistic neural network computational model that determines which factors provide greatest prognostic accuracy for improving daily use of a hemiparetic arm after CI therapy. Once the combinations with highest accuracy were identified, a neural dynamic classification algorithm was trained and tested for each combination to investigate if a more accurate prognosis is obtainable. Finally, a sensitivity analysis was performed to evaluate the effect of each predictor on the extent of improvement. Once the prognostic model with the greatest accuracy was identified, scatter plots of the prognostic factors were utilized to examine clinically important trends in the data.

**Results**: The most accurate prognostic model predicting improvement in arm use at 89.7% included the pre-treatment gross motor ability, fine motor ability, touch sensation, and daily use of the hemiparetic arm. Of these four factors, gross motor ability and touch sensation were the most influential predictors. Amongst best responders, two patterns of participant characteristics emerged: (1) those who demonstrated good pre-intervention gross motor function but poor sensation and fine motor function and (2) those with good pre-intervention fine motor function and sensation but decreased use of the affected arm in daily life.

**Conclusions**: Gross motor ability may be a necessary precursor in improving arm use during daily activities. Motor ability appears to be a direct predictor of improvement in arm use, whereas sensation moderates the ability of people with chronic post-stroke hemiparesis to achieve better gains in use after CI therapy. The Transfer Package components of CI therapy, which promote increased use of the weaker arm during daily life, may be most effective in these types of patients.

**Clinical Relevance**: The CI therapy Transfer Package should be incorporated into treatment programs of patients who present with either: (1) good overall motor ability and nonuse, or (2) who have good gross motor ability and poor sensation. Patients who present with poor motor ability may still benefit from the Transfer Package but improvements are more modest.
TITLE: The Overlap between Perceptions of Cardiovascular Demand and Task Difficulty in Individuals with Chronic Stroke Performing Moderate Intensity Exercise

AUTHORS/INSTITUTIONS: J. Wood, M.P. Drake, PM&R, Johns Hopkins Hospital, Baltimore, Maryland, UNITED STATES| D. Reisman, University of Delaware, Newark, Delaware, UNITED STATES| S.M. Morton, Physical Therapy, University of Delaware, Newark, Delaware, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: One important feature of exercise prescription for improving brain plasticity and enhancing recovery post-injury is intensity of exercise. Intensity is traditionally defined by the amount of energy utilization during exercise and is often quantified by oxygen consumption or heart rate (HR). In clinical applications, the Borg Rate of Perceived Exertion (RPE) scale is commonly used as a substitute for HR to quantify exercise intensity, as these two measures are thought to be correlated. However, measuring task intensity as cardiovascular demand does not capture the aspects of intensity that relate to task challenge or difficulty level. For example, training of complex fine finger movements could be very difficult, but would not be expected to produce a significant cardiovascular demand. Despite physical therapists being taught to determine the ‘just right challenge’ level for clients to maximize learning and plasticity, to our knowledge there are no known metrics to identify clients’ perceived task difficulty levels. The purpose of this study was to assess how individuals with stroke rate task difficulty and whether they perceive task difficulty as distinctly different from exertion or cardiovascular demand. We hypothesized that participants would identify task difficulty as distinct from (not correlated with) perceived exertion (RPE) or HR.

Number of Subjects: Ten individuals with chronic stroke who were enrolled in a separate clinical trial were included in this study.

Materials/Methods: Participants performed a variety of upper and lower extremity functional tasks that varied in terms of ‘difficulty’ and ‘exertion’ levels. For each task, HR, RPE and a rating of perceived task difficulty (RPD) were recorded. RPD was scored on an eleven-point (0-10) scale that was anchored with terms similar to the RPE, except with respect to task difficulty. Spearman rho correlation coefficients were used to determine the relationships between HR, RPE and RPD.

Results: We evaluated 454 total tasks from multiple training sessions. For both UE and LE activities, RPE and RPD were significantly correlated (r= 0.70, r= 0.42; p< 0.0001). RPE was not correlated with HR in any situation.

Conclusions: Participants with stroke did not distinguish between cardiovascular demand (RPE) and task difficulty (RPD), even during activities that, in the opinion of the testers, clearly were more oriented toward just one of the two constructs (e.g., fine finger coordination tasks). The finding that RPE and HR were not related to one another further suggests that participants may have used the construct of task difficulty to determine their task exertion ratings. Clinical Relevance: This study illustrates the complicated and intertwined concepts of task ‘exertion’ and ‘difficulty’. For clients with stroke, RPE scores may represent task difficulty as much or more than cardiovascular demand. A more objective measure, such as HR, may be more appropriate under circumstances where the goal is to measure cardiovascular demand.
TITLE: Perceived health and healthcare needs for people with neurological conditions and caregivers transitioning back to rural communities

AUTHORS/INSTITUTIONS: P. Kitzman, Physical Therapy, University of Kentucky, Lexington, Kentucky, UNITED STATES|B. Hunter, Gerontology, University of Kentucky, Lexington, Kentucky, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: The current study is part of a funded project exploring engagement of individuals with TBI, stroke, SCI and caregivers transitioning back to rural underserved communities to determine their relevant health and healthcare related priorities. The purpose of this study was to: 1) determine the overall needs facing these individuals as they transition home, 2) determine what information is relevant to them for their health decision making, and 3) determine where they access health information to make informed health decisions.

Number of Subjects: A total of 38 community dwelling individuals with SCI (n=5), TBI (n=9), stroke (n=8) or caregivers (n=16).

Materials/Methods: A mixed methodology approach was used in this multi-step project. A multi-stakeholder team conducted 17 in-depth interviews and 7 focus/workgroups (n=32 participants). Additionally, a short questionnaire was used to examine the relevant health information needs for health decision making and what sources are accessed to obtain health information.

Analysis: Qualitative analysis included data derived coding, inter-coder agreement, categorization schema, followed by development of themes. Descriptive analysis was used for interpretation of the questionnaire data.

Results: Overall the perceived needs across neurological conditions included better communication across the continuum of care, access to appropriate care and resources, and better partnership in the decision making process. Health information priorities: Patients: 1) chronic disease management, 2) how to access the appropriate doctors/providers, 3) specific information about their diagnosis (TBI, stroke, SCI), and 4) medication management. Caregivers: 1) how to access the appropriate doctors/providers, prevention, 2) wellness, 3) paying for healthcare, and 4) chronic disease management. Primary sources of health information: Patients: 1) doctors, 2) support groups/peers, 3) internet, and 4) family/friends. Caregivers: 1) doctors, 2) healthcare providers, 3) internet and 4) support groups/peers

Conclusions: Upon returning to rural communities from inpatient care, patients with TBI, stroke, or SCI and caregivers continue to have significant needs including: 1) improved communication between the individual, family and healthcare team, 2) access to knowledgeable providers and services, 3) access to follow-up information to guide health and healthcare decision making, and 4) support accessing resources needed to successfully implement the healthcare education and treatment plan. These individuals turn to multiple sources, some credible and some not credible, for this information.

Clinical Relevance: Physical therapists must engage the patients and caregivers to ensure treatment plans account for the whole person when preparing individuals with neurological conditions to return home. Communication is crucial as is linking patients and caregivers to essential resources and follow-up education to support a successful transition home.
Backward Walking Measures Better Identify Future Fallers in Multiple Sclerosis than Forward Walking

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Purpose/Hypothesis: Accidental falls are common among individuals with multiple sclerosis (MS). Better screening tools to identify future fallers are needed to prevent injurious falls and to ensure proper referrals for rehabilitation. Although differences in backward walking have been identified among healthy controls and individuals with MS, the relationship of backward walking to falls has not been explored.

Number of Subjects: Eleven individuals with MS have participated to date. Our sample includes 11 females with an average (SD) age of 53.3 (9.7) years and an average (SD) symptom duration of 14.2 (10.6) years. Ninety-one percent of the individuals were taking disease modifying therapies and 18% utilized walking devices during testing.

Materials/Methods: In a single session, we examined forward and backward walking performance over a GaitRite electronic walkway. Spatial and temporal gait parameters as well as coefficients of variation (CV) were calculated. Participants reported a retrospective 1-month fall history, and then were asked to keep a fall diary for the subsequent 6 months. Relationships among forward walking, backward walking, and both retrospective and prospective falls were evaluated with Spearman correlations.

Results: No forward walking measures were related to either retrospective or prospective fall status. Backward walking double support time (R=0.789; p=0.004), double support time CV (R=0.714; p=0.014) and velocity (R=-0.608; p=0.047) were significantly related to reports of retrospective falls at 1 month. Similarly, backward walking stride length (R=-0.738), double support time (R=0.738), and velocity (R=-0.949) were related to reports of prospective falls at 6 months. Backward walking better differentiated fallers from non-fallers. With retrospective fall reports, all fallers at 1 month had backward walking velocities of < 0.78 m/s; those who prospectively reported falls over 6 months had backward walking velocities of < 0.57 m/s.

Conclusions: Backward walking was strongly related to both retrospective and prospective fall reports, while forward walking was not related to fall reports. Backward walking speed better identified MS fallers than forward walking speed.

Clinical Relevance: Evaluation of backward walking velocity may be a useful tool to identify future fallers in individuals with MS.
TITLE: Concurrent Validity of the ViruSense® Gait Analysis System for the Quantification of Spatial and Temporal Parameters of Gait

AUTHORS/INSTITUTIONS: A.J. Strubhar, P. Tan, L. Jarrett, Physical Therapy and Health Science, Bradley University, Peoria, Illinois, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The ViruSense® is a novel motion analysis system based on infrared technology that requires further validation prior to widespread clinical application. This study was designed to assess concurrent validity of the VirtuBalance Real Time Gait Analysis System (a sub program of the VirtuSense® system) to two gold standards of gait analysis: the GAITRite® computerized gait mat and manual pedograph.

Number of Subjects: 27

Materials/Methods: 13 males and 14 females (mean age 25.6 years) performed 4 walking trials at a self-selected pace on a level surface. In the first trial, stride-length and step-length data were collected simultaneously by the GAITRite® (GR), VirtuSense® (VS), and pedograph (PG). In 3 trials, stride-length, step-length, and velocity data were collected simultaneously from the GR & VS. Intra-class correlation coefficients (absolute value) of the L and R stride length were calculated for the three measures in the first trial (GR, VS & PG). Pearson r correlation coefficients were calculated from the mean of the subsequent trials for step length, stride length and velocity (GR & VS).

Results: A high degree of reliability was found between the three measurement tools. The average measures ICC(3,3) for L stride length was .987 (95% CI .974-.994; F(26,52)=95.2, p<.001) and for R stride length was .983 (95% CI .965-.992; F(26,52)=72.3, p<.001). A statistically significant and high correlation was found among each gait parameter measured by the (GR) and (VS): LEFT stride length mean distance in cm GR=143.1, VS=142.1 (r=0.924,p<.001); RIGHT stride length mean distance in cm GR=143.4, VS=142.7 (r=0.986,p<.001); LEFT step length mean distance in cm GR=71.4, VS=70.9 (r=0.974,p<.001), and RIGHT step length mean distance in cm GR=71.8,VS=70.3 (r = 0.904,p<.001); Velocity mean cm/sec GR=126.3, VS=141.1 (r=0.854,p<.001).

Conclusions: The VirtuSense® gait analysis system, as compared to the GAITRite® and pedograph, demonstrates high concurrent validity for measuring gait parameters (stride length, step length, and velocity). The slower velocity with the GR could be due to the longer capture distance with the GR compared to the VS and inadequate acceleration phase in the methodology.

Clinical Relevance: The VirtuSense® appears to provide a valid measure of gait parameters thus may be a useful clinical tool. Previous gait analysis methods only examined the spatial and temporal parameters related to foot fall. The VS has the capacity measure limb and trunk movement during gait and is not limited to only foot fall. Thus, the VS could clinically quantify other of gait parameters (e.g. trunk forwards/backwards lean, trunk lateral lean, arm swing) not previously measured through other means. In addition, the VirtuSense® subprograms have the capacity to capture other movement domains such static and dynamic balance.
TITLE: The Influence of Carbon Composite and Plastic Ankle-Foot Orthoses on Balance and Gait in Individuals with Multiple Sclerosis: A Pilot Study

AUTHORS/INSTITUTIONS: K. Jackson, H. Goubeaux, C. Macy, T. Trauner, S. Hollis, University of Dayton, Dayton, Ohio, UNITED STATES|K.E. Bigelow, Mechanical and Aerospace Engineering, University of Dayton, Dayton, Ohio, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Multiple sclerosis (MS) can cause lower extremity weakness which can impair balance and gait. Ankle-foot orthoses (AFOs) are frequently prescribed to reduce the effects of these impairments. Despite numerous recent advances in the design and materials used for AFOs, there is a lack of evidence to guide clinicians in effective AFO prescription. The purpose of this research was to compare the effects of an anterior shell carbon AFO with a plastic AFO on measures of balance and gait performance. We hypothesized that the carbon AFO would lead to greater improvements in dynamic balance and gait activities while the plastic AFO would be superior during the static balance activities.

Number of Subjects: 8 individuals (mean age = 57 ± 10.5) with MS and mild to moderate disability (mean EDSS = 4.5 ± 1.6) who had not used an AFO previously.

Materials/Methods: Participants gait and balance were tested at approximately the same time of day on three separate occasions under the following AFO conditions: 1) no AFO, 2) carbon AFO, 3) plastic AFO. Balance was assessed using a force plate during quiet standing under manipulated sensory conditions and during a limits of stability (LOS) assessment. Gait quality and speed were assessed using wireless body worn sensors during a 10-meter walk and gait endurance was assessed using the 6-minute walk test (6MWT) distance and physiological cost index.

Results: No significant differences were identified between the three AFO conditions for any of the outcome measures. However, individual participants demonstrated both positive and negative responses to the different conditions that could influence appropriate AFO prescription. Participants subjectively preferred the carbon AFO to the plastic AFO by a margin of 5 to 3.

Conclusions: There were no group differences in a variety of balance and gait measures between AFO conditions. However, individual responses to the AFO conditions were varied and should be considered during the prescription process. The majority of the participants subjectively preferred the carbon AFO.

Clinical Relevance: These findings support an individualized approach to AFO prescription for persons with MS. The use of instrumented measures of gait and balance, combined with clinical expertise and patient preferences, may help to optimize individual outcomes.
Background & Purpose: Motor impairments following a stroke often include weakness and the use of abnormal movement patterns. The use of visual feedback and an external focus of attention have been shown to improve motor performance in individuals with and without neurological disorders. Recently, a trunk and limb mounted laser guidance system (Motion Guidance, USA) has become commercially available to provide visual feedback to individuals undergoing rehabilitation. To our knowledge, the use of laser guidance for improving motor performance has not been previously explored in persons with stroke. Therefore, the purpose of this case study was to investigate the feasibility and immediate effects of laser guided visual feedback of lower extremity movement in an individual with chronic stroke.

Case Description: The participant was a 78 y/o male with a chronic right CVA and left hemiparesis (LE Fugl-Meyer = 26/34). An 8-camera motion analysis system (Vicon, USA) was used to capture lower extremity kinematics during a repeated standing maximum hip and knee flexion lift activity while using a limb mounted laser device. Ten repetitions were completed without laser feedback, with laser feedback and immediately post laser feedback with a 3-5 minute rest between each trial.

Outcomes: The mean maximum hip flexion angle achieved without laser feedback, with laser feedback and post laser feedback was 70.7, 74.9 and 80.5 respectively. The mean maximum knee flexion angle achieved without laser feedback, with laser feedback and post laser feedback was 69.7, 73.4 and 81.5 respectively. The mean hip abduction angle without laser feedback, with laser feedback and post laser feedback was 16.6, 12.7, and 17.9 respectively.

Discussion: Visual feedback provided by a limb mounted laser device, elicited immediate improvements in lower extremity movement in an individual with chronic stroke. Further research into the long-term training effects and potential carry-over to functional tasks may be warranted for this simple and inexpensive training tool.


ABSTRACT BODY:

Background & Purpose: Myasthenia Gravis (MG) is a rare autoimmune disorder in which antibodies target the neuromuscular junction of skeletal muscles, leading to widespread weakness and fatigability of skeletal muscles including the diaphragm. The exact role of exercise in management of MG has not been delineated, particularly in the acute setting. Research has demonstrated the efficacy of physical therapy treatment in various other neuromuscular diseases including post polio syndrome, multiple sclerosis, amyotrophic lateral sclerosis, and muscular dystrophy. The purpose of this case report is to describe the effectiveness of physical therapy treatment at improving balance, strength, gait, and functional ability for a patient with MG in the acute care setting.

Case Description: The patient was previously an independently functioning 68-year old retired male who presented to the neuro-surgical intensive care unit of a local hospital for symptoms including progressive respiratory distress and progressive dysphasia. He was later diagnosed with MG. During his 30-day hospital stay, he underwent 16 physical therapy treatments designed to improve cardiovascular fitness, muscular strength and balance in conjunction with medical management of condition. The patient’s primary goals were to return to or improve his prior level of function and to return home. His return home was complicated by the fact that he had 22 stairs leading to his front door. The progressive overload principle was employed during task-specific and functional application of exercise emphasizing cardiorespiratory fitness, lower extremity strengthening and balance.

Outcomes: Outcomes were assessed using the Two Minute Walk Test (2MWT), Five Times Sit to Stand (5TSS) and the Tinetti Performance Oriented Mobility Assessment (T-POMA). Following 16 sessions of physical therapy treatment, the patient exhibited significant improvements across all of these parameters. At the time of hospital discharge, he had met the minimal detectable change for all outcome measures. Additionally, the patient achieved the ability to ambulate up and down 22 stairs, demonstrating the ability to overcome his primary environmental barrier to return home safely. The patient did not experience any adverse events during the physical therapy sessions; e.g. respiratory distress.

Discussion: The use of the progressive overload principle, task-specificity and functional application of tasks led to significant increases across all outcome measures utilized during this patient’s hospital stay. Most importantly, the patient improved his functional mobility sufficiently that he was able to return home, representing his primary goal for physical therapy. The results of this case study suggest that, in conjunction with proper medical management, physical therapy treatment may be useful in improving cardiovascular fitness, lower extremity strength and balance in the acute care of patients with MG. More research is required to reproduce the results achieved here and to determine optimal exercise dosage.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Purpose/Hypothesis: People with neurological conditions frequently have mobility impairments that lead to reduced gait speed. These impairments are not always ameliorated with physical therapy interventions. Balance-based torso-weighting (BBTW), a system of strategically placing light weights on the torso to improve response to balance perturbations, has resulted in immediate small improvements in clinical measures, including gait speed, in persons with Multiple Sclerosis (MS), but has not been studied in individuals with other neurological conditions. The purpose of this study was to evaluate the impact of BBTW on gait speed in individuals with a variety of neurological conditions.

Number of Subjects: This study included 45 individuals with a primary neurological diagnosis referred to Physical Therapy for a Balance-Based Torso Weighting Vest (BBTW) Evaluation.

Materials/Methods: Data was collected via a retrospective chart review of the medical records of 64 individuals who presented to a University based Neurology Clinic for a BBTW Evaluation. During this evaluation preferred gait speed was measured via the 25 foot walk test prior and post strategic placement of light weights according to the BBTW protocol. As part of the assessment, additional demographic data including age, gender, and relevant medical diagnoses (including presence of scoliosis) were collected. SPSS v 22 was used for statistical analysis of data collected.

Results: Of the 64 medical charts reviewed, 45 met the inclusion criteria of at least one diagnosed neurological condition. Of the 45 subjects (mean age = 51 years), 30 were female. Sixteen subjects had a primary diagnosis of Parkinson's Disease, Ataxia, Brain Injury or Stroke and the remainder had a primary diagnosis of MS. The average gait speed, regardless of diagnosis, increased by .39 ft/sec with the addition of torso weighting using the BBTW protocol. This translated into an overall improvement in gait speed of 26%. Persons with a dual diagnosis of MS and Scoliosis (n = 7) had the greatest average change in gait speed (27.95%). Comparison of pre-BBTW and post-BBTW mean gait speed with Student's paired t-test (2 tailed) support the clinical significance of these results, [t(44)= 6.37, p< .05]. The small sample size limits the generalizability of these findings for individuals with a neurological diagnosis other than MS.

Conclusions: The results of this small study indicate that BBTW use has an immediate significant effect on gait speed for persons with a neurological diagnosis. Individuals with MS and scoliosis demonstrated the greatest increase in gait speed. Further research, using a larger sample, should evaluate gait speed over a longer distance to evaluate the impact of BBTW on gait endurance for individuals with various neurological conditions.

Clinical Relevance: BBTW can result in immediate gait speed improvements in persons with neurological conditions other than Multiple Sclerosis.
TITLE: The Effect of Isolated Attention Training on Motor Performance


ABSTRACT BODY:

Purpose/Hypothesis: Recent EEG evidence has confirmed behavioral studies that demonstrate how postural tasks and visual attention tasks compete for similar executive attention resources. Additionally, there is evidence that training attention in isolation improves the performance of contextualized motor skills in healthy athletes. It has not been established if this training specifically affects motor performance or the attentional component of contextualized motor tasks. The purpose of this study was to develop a testing and intervention protocol to test the effect of attention training on motor tasks. We hypothesized that attention training in isolation will have a specific effect on motor task performance.

Number of Subjects: 19

Materials/Methods: For this pilot study, nineteen healthy young adults (10M, 9F), ages 22-30-years-old were recruited from the Touro College Manhattan Campus in NYC. Consent, demographic and anthropometric data (height, weight, leg length) were obtained from all subjects. The subjects were randomly assigned to an experimental or control group. Pre- and post-test outcome measures were administered to all participants for motor performance of walking on the GAITRite Portable Walkway System® and balance using the Star Excursion Balance Test (SEBT). The experimental group received an attention training intervention using the NeuroTracker-3D Perceptual Cognitive Training® system, for a total of 8 sessions.

Results: A Mann-Whiney U test revealed significant between-group differences on the post-test SEBT for 5 of the 16 directions (Medial R: p=0.035; posterior medial R: p=0.013; posterior lateral L: p=0.043; posterior medial L: p=0.01; lateral L: p=0.004). No significant between-group difference was found for spatiotemporal variables of post-test gait as measured on the GAITRite®. A Wilcoxon Signed Rank Test indicated significant improvement in attention scores on the NeuroTracker® task for the experimental group between the first and third moving average measures (p=0.008).

Conclusions: The findings of our pilot study suggest that healthy young adults who received isolated attention training using the NeuroTracker® software demonstrated improved motor performance on novel motor tasks that require attentional resources, such as the SEBT, but not on well-practiced motor tasks, such as walking. In subsequent studies, novel components to the walking task should be included to increase likelihood of discerning benefits of training on contextualized walking.

Clinical Relevance: This pilot work suggests that training the attention system in isolation has a positive impact on motor performance for healthy young adults. This tool could potentially be useful as a clinical intervention for varied patient populations with neurodevelopmental or neurodegenerative disorders.
TITLE: Oxygen Uptake and Muscle Activation While Walking in an Exoskeleton with Variable Assistance in Individuals with Incomplete Spinal Cord Injury

AUTHORS/INSTITUTIONS: A. Domingo, C.G. Baxter, S. Ball, L. Kennard, B. Pham, S.J. Rosario, C.T. Sanscartier, Doctor of Physical Therapy Program, San Diego State University, San Diego, California, UNITED STATES|J. Kressler, School of Exercise and Nutritional Sciences, San Diego State University, San Diego, California, UNITED STATES

ABSTRACT BODY:

Background & Purpose: A significant effect of a spinal cord injury is the loss of functional walking capacity, severely limiting participation in daily activities, decreasing health and quality of life. Recently, wearable bionic exoskeletons, such as the Ekso, have been developed for gait rehabilitation. The Ekso has the unique ability to provide variable levels of assistance during overground walking for those with lower extremity weakness, facilitating improved muscle activation by increasing engagement and task specific practice. With increased activation of lower extremity musculature, there is the potential to improve cardiovascular fitness in individuals with motor-incomplete SCI (m-iSCI) and reduce secondary complications due to immobility. The purpose of this study was to compare oxygen uptake (%VO$_2$max) and muscle activation during walking in the Ekso across different levels of assistance in participants with m-iSCI. We hypothesized that minimizing assistance from the Ekso during walking would result in greater user effort and muscle recruitment.

Case Description: 4 subjects with m-iSCI performed three 6 minute walk tests (6MWT) in the Ekso. For the 1st trial, subjects walked in Max mode (the Ekso moves the legs through a predetermined swing phase trajectory regardless of the effort of the user). For the 2nd and 3rd trials, subjects received variable assistance in 2 different modes, in random order: Adaptive (the Ekso lowers assistance based on how well the user follows the trajectory) or Fixed (the maximum level of assistance provided is set by the physical therapist). We measured %VO$_2$max and Rating of Perceived Exertion (RPE) during each 6MWT. Electromyography (EMG) was recorded from 6 lower extremity muscles bilaterally.

Outcomes: Robotic assistance was higher in Adaptive than in Fixed mode for all subjects. %VO$_2$max was higher in Fixed than in Adaptive (1-8%) for all subjects, higher in Fixed than in Max in 3 subjects (2-28%), and higher in Adaptive than in Max in 2 subjects (4-22%). RPE was higher in Fixed than in Adaptive (2-6) in 3 subjects and the same in the 4th, higher in Fixed than in Max in all subjects (2-7), and higher in Adaptive than in Max in 3 subjects (1-3) and the same in the 4th. EMG amplitudes were variable between subjects and assistance modes.

Discussion: The RPE and %VO$_2$max data suggest that with decreasing assistance from the Ekso, user effort and engagement of the cardiorespiratory system increased. Therefore, using an exoskeleton with variable assistance during walking could help with improving cardiovascular fitness and health in individuals with m-iSCI. Our data did not indicate a strong relationship between muscle activation and assistance level. One possible explanation for this finding was that we only collected EMG from 6 leg muscles. Other muscles, such as those in the trunk, proximal hip and upper extremities, are also likely active during ambulation with the Ekso, especially in individuals that are unable to activate more distal leg musculature.

Music Supported Therapy Enhances Upper Extremity Recovery of Function Following Stroke: A Systematic Review

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Purpose/Hypothesis: Music has been shown to activate multimodal brain systems. While it has been used to improve gait and lower extremity function in stroke, music has not been extensively studied for upper extremity (UE) recovery of function (ROF). Music Supported Therapy (MST), a relatively new form of auditory feedback that encourages creation of music with musical instruments, has the potential to enhance ROF in the UE through activation of similar multimodal pathways. The purpose of this systematic review is to examine if MST is an effective therapeutic intervention for UE ROF following stroke.

Number of Subjects: Eleven intervention studies with 301 individuals [160 experimental with stroke (ES); 104 controls with stroke (CwS); 37 controls without stroke (CnS)] were reviewed.

Materials/Methods: Three databases were searched from inception to December 2016 with inclusion criteria: survivors of stroke with UE impairment, ≥18 years old, any race or gender, cognitively intact and without prior knowledge of using a musical instrument. Each study’s quality and reliability was assessed using the Joanna Briggs Institute Critical Appraisal Checklist: Quasi-Experimental Studies, Case Reports, and Randomized Controlled Trials. The reproducibility of the interventions was assessed using the Template for Intervention Description and Replication Checklist. Primary outcome measures as determined by StrokEDGE recommendations with their significance values were extracted for: Fugl-Meyer Assessment of Motor Performance (FM), Action Research Arm Test (ARAT), Wolf-Motor Function Test (WMFT), Nine Hole Peg Test (9HPT) and Box and Block Test (BBT). Where possible, effect sizes were calculated using Cohen’s d statistics.

Results: Eleven studies (n=7 quasi-experimental, 2 RCT, 2 case studies) met our inclusion criteria. For the individuals in the studies, chronicity of stroke was chronic (n=4), subacute (n=5) and mixed (n=2). The most frequently used dosage for MST was 30-minute sessions, 4-5 times per week for 3-4 weeks. Significant improvements (p<0.05) were reported in all studies for the following primary outcome measures: ARAT (n=5), subscales of WMFT (n=2), 9HPT and BBT (n=4 each). In 5 studies using CwS, the between group effect sizes measures ranged from small (BBT:d=0.33;n=1) to large (all primary outcomes:d=0.8-2.17;n=4). In 2 studies using CnS, the within group effect sizes for the ES were small (d=0.25-0.40) for ARAT and BBT.

Conclusions: This systematic review demonstrates that MST appears to be effective in the restoration of gross and fine-motor UE function following stroke in both sub-acute and chronic phases. Further study is required to compare MST to other well-established interventions.

Clinical Relevance: MST is a promising and suitable intervention for restoration of UE function following stroke. If a therapist chooses to use MST then a standardized protocol should be followed.
TITLE: Balance Rehabilitation and Assessment using Virtual Environments for a Patient with Bilateral Vestibular Dysfunction


ABSTRACT BODY:

Background & Purpose: Falls typically occur within changing environments, as a result of unexpected external forces, and when multitasking. These situations are particularly challenging for patients with sensory deficits who may deal with high levels of anxiety associated with loss of balance when exposed to busy and complex environments. Using advances in virtual reality technology we developed Balance Rehabilitation and Assessment using Virtual Environments (BRAVE) platform. The purpose of this case report is to describe the application of BRAVE for a patient with bilateral vestibular dysfunction (BVD).

Case Description: A 62-year-old woman was diagnosed with BVD due to Anti-Neutrophil Cytoplasmic Autoantibody vasculitis. On initial evaluation with the BRAVE platform, the patient was fearful of the virtual ball in the park, and avoided the ball by turning her head to look away. She was unable to stand on an unstable surface with any visual movement without holding onto canes. We trained the patient for 8 sessions in abstract park and busy street scenes. During the park scene we asked her to “keep your eyes on the ball” and “move big”. On the street scene we increased the length of practice, utilized the faster moving shapes, and asked her to move her head up and down.

Outcomes: The patient’s head rotation (as measured by the headset) decreased to a level that resembled a healthy young control (from 8.56 mm to 4.7mm). Tactonic pressure mat showed that her root mean square of velocity in static stance (trying to stay steady when standing on foam with feet together) decreased from 46.5 mm/s to 29.5 mm/s medio-lateral (ML) plane and from 75.23 mm/s to 36.7 mm/s in the anterior-posterior (AP) plane. Similar decreases were shown by a Kistler force-plate. She also no longer needed to use the canes for this task. Her AP displacement in the park decreased, as measured by the pressure mat and the forceplate (e.g., from 911 mm in the dark part to 574 mm, Tactonic data) but increased in the ML plane (e.g., 1021 mm to 1468 mm on the dark segment) suggesting better control of movement outside of her base of support in a dynamic task without loss of balance. Her Dizziness Handicap Inventory improved from 18 to 6, Activities-specific Balance Confidence Scale from 73.12% to 90.63% and her State and Trait Anxiety Inventory from 46 to 30 and 42 to 31 respectively.

Discussion: The BRAVE platform includes an Oculus Rift VR headset which provides the visual environment as well as head tracking data, and Tactonic sensors to quantify postural sway. This is the first case to describe the application of BRAVE for the treatment of a patient with BVD. We observed a successful transfer between performance on the platform to daily living function and balance confidence. After 8 weeks of training, the patient reported that she does not need to think about her balance and does not fear the flow of people in the street.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): References

4. Julian LJ. Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Arthritis Care Res Hoboken. 2011;63 Suppl 11:S467-472.
background & purpose: Benign Paroxysmal Positional Vertigo (BPPV) is the most common cause of dizziness, which usually resolves spontaneously or with canalith repositioning treatment (CRT). In clinical practice, atypical BPPV has been observed and is less responsive to traditional CRTs. High-resolution magnetic resonance imaging studies have reported morphological abnormalities in the inner ear of patients with intractable BPPV. Recent studies show adolescents with idiopathic scoliosis exhibit morphological vestibular asymmetry: 1) left horizontal semicircular canal (SCC) and left posterior SCC anatomy were significantly further from midline, 2) displacement of the horizontal SCC from the midline resulted in more vertical alignment.

case description: 67 year old male was referred to physical therapy with diagnosis of central vertigo. Past medical history included scoliosis. The patient (pt) reported intermittent episodes of vertigo and generalized dizziness. Symptoms were provoked with bed mobility, computer use at work, and playing tennis. Vestibular examination was unremarkable except for atypical presentation during BPPV testing. Right Dix-Hallpike revealed right torsional upbeat nystagmus (RTUBN), more pronounced in 30 degrees of cervical flexion. Roll testing revealed RTUBN in right roll which reversed into left torsional downbeating nystagmus (LTDBN) with left roll, all reproducing symptoms. Differential diagnosis included posterior canal or horizontal canal involvement due to nystagmus observed and provocation position. Outcome measures revealed impaired dynamic balances, FGA score 24/30, and mild self-reported disabilities, DHI score 16/100.

Initially, pt was treated with right CRT, Semont, and Appiani maneuvers with poor response. Modified CRTs for right posterior canalithiasis were then trialed, performed with pt's head in 30 degrees of cervical flexion during treatment due to greatest provocation of symptoms and nystagmus in this position. Residual motion sensitivity was addressed via habituation exercises.

outcomes: Following the modified treatment, pt was asymptomatic during all canals BPPV testing. There was only faint RTUBN noted in the right roll test. Pt demonstrated improvement in dynamic balance; FGA improved to 30/30 and reduced self-reported disability, DHI improved to 4/100. He was asymptomatic with bed mobility, home, work and leisure activities.

discussion: Studies have demonstrated associated anatomical differences in patients with scoliosis. Atypical presentation of BPPV may be related to SCC anomaly and spine deformity. When treating patients with intractable BPPV, scoliosis screening may be recommended, as patients may present with associated SCC anomaly, possibly requiring modifications of canalith repositioning maneuvers. This case study demonstrates successful treatment of a pt with an atypical presentation using modified CRTs that utilized angle of greatest symptoms and nystagmus provocation. Further studies are suggested to determine if intractable BPPV is common in pt's with scoliosis.

references: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

AUTHORS/INSTITUTIONS: M. Zeleny, Kessler Institute for Rehabilitation, West Orange, New Jersey, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Many patients in acute rehabilitation present with co-morbidities that further challenge function in addition to deficits related to their primary diagnosis. Recent data suggests that 37 million people worldwide are blind, many of which use a white cane for independence and safety. It is well established that visual impairment is known to negatively impact balance, postural stability, and gait kinematics. Vision loss has shown to negatively impact functional independence and decrease the efficiency in which rehabilitation goals are achieved. Research suggests that vision loss at any level restricts the participation domain on the international classification of functioning disability and health (ICF) model. Therefore, a physical therapy plan of care should include treatment strategies that specifically address visual impairments in addition to those resulting from the primary diagnosis. The purpose of this report is to present a case of a subject with blindness for which co-treatment with a mobility specialist from the New Jersey Commission for the blind, in conjunction with traditional physical therapy interventions, enhanced patient outcomes.

Case Description: This case report describes physical therapy treatment in an inpatient acute rehabilitation setting for a blind individual with a neurological diagnosis which effects strength and sensation. As a result of the collaboration, the treating physical therapist learned how to use a white cane and adjusted gait training strategies to incorporate its use effectively. Modifications were made to treatment strategies, including environmental set up, use of repetition, and improving patient sense of security.

Outcomes: This subject spent 29 days in an inpatient rehabilitation facility. This subject demonstrated an overall 43 point change on the functional independence measure (FIM), and a 41 point change on the motor portion of the FIM. Improvement in manual muscle test scores, and overall level of assistance for transfers, elevations, and ambulation were made. Most significantly, this subject required total assistance for ambulation at admission and was able to ambulate community distances with close supervision using a platform walker and her white cane together at discharge. Qualitative improvements in all of these domains were made.

Discussion: These results suggest that physical therapists should consider collaboration with community resources for more individualized treatment plans, enhanced efficiency in achieving rehabilitation goals and to decrease burden of care upon discharge. This patient also received more specific and relevant instruction from the certified mobility instructor at home after collaboration with the physical therapist. More research is needed to assess quality of life implications for blind patients and specific interventions for physical therapy practice.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Dystonia Gravidarum Improved After Joint Position Error Training

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ABSTRACT BODY:

Background & Purpose: Describe a case of new dystonia gravidarum improving with joint position error training.

Case Description: AB is a previously healthy 34-year-old lady who developed new onset cervical dystonia (CD) within the first month of her pregnancy. Her symptoms began within a week of conception, and developed into CD with severe anterocollis and right rotation with a dystonic head tremor. Her symptoms were severe enough to affect her work and require full disability leave. Initially a sensory trick would temporarily improve her symptoms, but this stopped being effective after several weeks. The patient sought out evaluation from a movement disorder specialist and a presumptive diagnosis of dystonia gravidarum was made based on two previous case reports described in two primiparous women in China and Italy. Due to her pregnancy, traditional treatments for CD, including botulinum toxin, were considered high risk for the unborn fetus. She was referred to a local physical therapist who specializes in movement disorders. Treatment focused on using joint position error (JPE) training, which is a method that aims to assess the patient’s ability to return their head back to neutral position using a laser centered on her forehead and a target 90 cm in front of the patient. The patient was assessed with ten trials on each side at every session and instructed to perform the exercises at home for five minutes, daily. This technique was used in conjunction with other physical therapy interventions, including strengthening, stretching, and manual therapy to address hyperactivity of neck muscles and weakness of scapular stabilizers.

Outcomes: AB made significant progress over the course of her pregnancy. AB rated her ability to perform self-identified activities (i.e. eating, putting on makeup, driving, looking at a computer screen) using the Patient specific Functional Scale, which improved from 75% to 5% impaired. TWSTERS scale improved from 71% to 8% impaired after giving birth. Joint position error assessment indicated 63% and 47% improvement in her ability to relocate her head on her trunk after active head movement to the left and right, respectively.

Discussion: Dystonia gravidarum is a very rare clinical syndrome that has only been described in two previous case reports. Pregnancy limits the treatment options for dystonia, but in this case the patient is improving subjectively as well as objectively after undergoing treatment with JPE. JPE should be considered as a treatment for future cases of dystonia gravidarum.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: The Impact Of Cardiovascular Treadmill Training To Improve Neurogenic Hypotension In A Patient With Cerebellar Multiple Systems Atrophy: A Case Report

AUTHORS/INSTITUTIONS: N. Trivison, Physical Therapy, University of Florida, Winter Park, Florida, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Multiple Systems Atrophy (MSA) is a rare, degenerative neurological condition considered to be the most widespread, rapidly progressing type of Parkinsonism. MSA-C is a subtype characteristic of cerebellar involvement and primary autonomic dysfunction with presentation of impaired coordination and neurogenic orthostatic hypotension (nOH). NOH is a sudden drop in blood pressure upon position change from laying to sitting and sitting to standing that severely impairs activities of daily living and is the most common cause of mortality in this population. Currently, there are no Clinical Practice Guidelines for MSA. The purpose of this case study was to ascertain if a treadmill training cardiovascular protocol can improve blood pressure dysautonomia in a patient with MSA-C.

Case Description: A 57-year-old male with MSA-C presented with nOH, impaired cardiovascular endurance, ataxic gait, poor balance, and depression with goals to improve gait mechanics and endurance for walking.

Outcomes: Baseline tests were recorded for orthostatic hypotension measured in sitting and within 3 minutes of standing resulted in nOH, endurance was measured using the 6 minute walk test (6 MWT) and a score of 474.24 m, balance was measured using the Mini Balance Evaluation Systems Test (MiniBEST) and a score of 16/32, functional mobility was measured using the 10 meter walk test (10 MWT) and a score of 1.04 m/s and quality of life was measured using the PDQ-39 and DHI scored 23.75 and 40/100 respectively. Intervention for a walking aerobic training program was provided using a treadmill for 12 sessions over 11 weeks progressing speed and grade as tolerated. Sessions were aimed at maintaining heart rate in his target HR zone to improve aerobic capacity. Post-scores showed meaningful changes on the MiniBEST (24/32) and 10-MWT (0.74 m/s). Improvements in nOH and 6 MWT (485.7 m) were also attained, while scores on the PDQ-39 (25.99) and DHI (54/100) declined after 12 weeks.

Discussion: Meaningful differences in balance and functional mobility along with improvements in nOH and endurance using cardiovascular treadmill training suggest a treadmill training regimen may be a beneficial treatment for improving nOH in patients with MSA-C. However, further research is needed to determine long-term effects, proper dosing and compare different modes of aerobic exercise.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): 1. Metzler, M., Duerr, S., Granata, R., Krismer, F., Robertson, D., & Wenning, G. K. (2013). Neurogenic orthostatic hypotension: pathophysiology, evaluation, and management. Journal of Neurology, 260 (9), 2212-2219.  
TITLE: The Application of Shaping Techniques with Lower Extremity Exercises for Community Dwelling Adults with Chronic Stroke: A Feasibility Study

AUTHORS/INSTITUTIONS: E.S. Moore, S.P. Kelly, College of Health Sciences, University of Indianapolis, Indianapolis, Indiana, UNITED STATES|B. Gustafson, S.A. Combs-Miller, Krannert School of Physical Therapy, University of Indianapolis, Indianapolis, Indiana, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study was to investigate the feasibility and effects of applying the principles of shaping to part-task, pre-gait activities in persons with chronic stroke. We hypothesized that shaping part-task, pre-gait exercises would be feasible and result in positive treatment effects across all levels of the International Classification of Functioning, Disability and Health.

Number of Subjects: Eleven participants with chronic stroke completed this prospective, repeated measures study (6 male; mean age 61.18 ±10.41 years; median months post stroke 18.00 IQR 10.00; 7 left hemiparesis).

Materials/Methods: The intervention was administered five times a week for two consecutive weeks for 60 minutes each session. Each exercise was completed in a bout of ten 30-second trials. Exercises addressed common gait impairments such as decreased stance time, swing time, step length, adaptability and dual-task ability. Upper extremity support was used as needed. Repetitions were counted with a tally counter. Verbal praise and informing participants of repetitions contributed to shaping. Sample exercises included: kicking a small ball, stepping on pom poms thrown randomly to left or right foot, and stepping to a target. Outcomes assessed at baseline, post and retention were Five Times Sit to Stand (5xSTS), Functional Gait Assessment (FGA), Activities Specific Balance Confidence Scale, and gait symmetry for step length, swing time, stance time and velocity measured on an electronic walkway.

Results: The group of participants met pre-determined benchmarks for feasibility: intervention completion rate (100%), safety (0 falls, 0 emergency calls), tolerance (90% tolerated 30 second trials), 15% increase in repetitions (100%) and personnel (100% required two or less helpers). The attendance benchmark was not met (63% attended all 10 sessions). There was an increase in mean repetitions per session from 594 during days 1-3 to 1026 on the final day of intervention (P=.003). Only the 5xSTS and the FGA showed statistically significant improvements over time (P<.01). These changes were not associated with the number of repetitions performed.

Conclusions: The study protocol was feasible and safe to implement with our sample with chronic stroke. The protocol yields a high number of repetitions in a short, intense time with a positive treatment effect for functional measures of lower extremity strength and gait activity. Lengthening the duration of the protocol beyond a two-week time-period, with less visits per week may improve attendance. Lack of improvements in gait symmetry may have been due to not practicing continuous patterns of walking outside of part-task activities.

Clinical Relevance: Use of shaping techniques by physical therapists in clinical practice may provide a systematic means of increasing practice repetitions. The addition of continuous gait activities and/or manipulation of upper extremity support could enhance outcomes.
Inter-rater reliability of shear wave ultrasound elastography in the biceps brachii muscle of individuals with chronic stroke

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Shear wave ultrasound elastography (SWUE) is an emerging clinical tool that may augment existing subjective tests of skeletal muscle length and end feel by measuring material properties, such as passive muscle stiffness, that are thought to increase in skeletal muscle following stroke. As a promising tool to include in the clinical environment, it must be readily used, specifically among novice users. However, the reliability of using SWUE among novice users is unknown. Therefore, the objective was to evaluate the inter-rater reliability of SWUE in the biceps brachii of individuals with chronic stroke. We hypothesized excellent inter-rater reliability (ICC: 0.75-1.0) and greater passive muscle stiffness with elbow extension.

12 participants with chronic hemiparetic stroke (8 males, 4 females; 59.9±7.9 years; 10.6±5.5 years post-stroke; 24.5±9.8 Fugl-Meyer Score) provided consent and completed the study.

Five 2nd-year DPT students were trained to perform SWUE of the biceps muscle until their shear wave velocity measurements on a practice model achieved a mean absolute deviation of ≤4%. For the reliability investigation, 20 standardized stretches were first performed at 120°/sec by a robotic device to achieve quiescence in surface electromyography (EMG). Each rater administered SWUE of the biceps brachii in two randomly-ordered positions (30°/70° elbow flexion) while the participant was at rest. Rater order was randomized within each testing position, and each rater acquired five consecutive images per position. EMG signals were continuously monitored for quiescence. Mean shear wave velocity was then calculated for each position of each rater. Inter-rater reliability was evaluated for each position with an ICC(2,5) (two-way random, average measures, absolute agreement). Additionally, a repeated measures analysis of variance (ANOVA) on a two-way mixed-effects model tested for an effect of rater and position on shear wave velocity.

The ICC(2,5) was 0.99 (95% CI: 0.98-1.00) for 30° and 0.77 (95% CI, 0.47-0.93) for 70° of elbow flexion. A significant effect of rater was not found (p<0.001), whereas shear wave velocity at 30° (3.9±1.4m/s) was 58% greater (p<0.001) than at 70° (2.6±0.5m/s).

Excellent inter-rater reliability was found for trained novice users to measure shear wave velocity to estimate stiffness using SWUE, especially at the extended elbow position. The lower ICC coefficient in 70° of flexion was not corroborated by an effect of rater in the ANOVA. Finally, increased shear wave velocity at the extended elbow position upholds prior work demonstrating that muscle stiffness increases with lengthening.

The performance of SWUE may be more difficult for novice users when the biceps is in a shortened position increasing measurement variability within individual participants. Excellent inter-rater reliability in lengthened positions supports clinical application that will serve to augment conventional qualitative evaluation of muscle properties.
Impact of a 12-Week Wellness Program on Subjects with Chronic Incomplete Spinal Cord Injury

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Purpose/Hypothesis: Individuals with spinal cord injury (SCI) can make gains in aerobic capacity, strength, and quality of life (QOL) with exercise but often do not participate in regular exercise due to physical barriers to access, decreased knowledge of fitness health professionals about SCI, lack of adaptive equipment and/or programs, and membership fee. This is a shame because individuals with SCI reap the same exercise benefits as their able-bodied peers including decreased risk of chronic conditions or secondary complications. A physical therapist (PT) supervised wellness program can address barriers to exercise for individuals with SCI. The purpose of this study is to investigate the impact of a PT designed wellness program for individuals with chronic SCI on aerobic capacity, strength, ambulation ability, and QOL.

Number of Subjects: Three males (39-53 years) with chronic incomplete SCI. American Spinal Injury Association (ASIA) scores were C2 ASIA D, T12 ASIA C, and C5 ASIA D.

Materials/Methods: All subjects attended structured one-hour training sessions together designed and supervised by a PT 3 times a week for 12 weeks focusing on the following: Aerobic, strength, and gait training. Measurements of strength (Handheld Dynamometry {HHD} for ASIA key muscle groups for the lower extremity motor score {LEMS} or upper extremity motor score {UEMS} and ASIA Impairment Scale), aerobic capacity (Six Minute Arm Ergometer Test {6 MAET}), gait (Walking Index for Spinal Cord Injury II {WISCI-II}, 10 meter walk test {10 MWT}), and QOL (Craig Handicap Reporting Technique {CHART}, World Health Organization Quality of Life BREF {WHOQOL-BREF}) were complete prior to and after the program.

Results: All subjects increased strength of key muscle groups as measured by HHD (12 for A, 2 for B, and 9 for C) and ASIA exam LEMS or UEMS (A 1 point LEMS, B 2 points LEMS, and C 5 points UEMS). Subject B converted from a T12 ASIA C to D. All subjects demonstrated a decrease in resting systolic blood pressure (BP) and HR as measured by 6 MAET (A 15/7; B 31/0; C 9/16). Subjects C and A demonstrated greatest gains in 10 MWT at fast walking speed, 0.14 and 0.03 m/s respectively. All subjects improved in the mobility subset of the CHART (8, 5, and 7 points respectively for A, B, and C) with Subject C increasing his total CHART score 98.8 points. The WHOLQOL-BREF demonstrated gains for all subjects in physical health (12, 6, and 8 points for A, B, and C respectively) and environment domains (12, 6, and 8 points for A, B, and C respectively).

Conclusions: A PT guided wellness program was effective in improving strength, ambulation, aerobic capacity, and QOL for three individuals with chronic incomplete SCI. The most beneficial aspects of this program were customization of exercise prescription by a PT, gait training, and the camaraderie and motivation gained by exercising together.

Clinical Relevance: Commitment to a PT supervised wellness program for individuals with chronic SCI is an important element of long term SCI management and prevention of secondary complications.
TITLE: Reliability, Validity, and Responsiveness of the Mini-Balance Evaluation Systems Test (Mini-BESTest) in Individuals with Multiple Sclerosis

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ABSTRACT BODY:

Purpose/Hypothesis: The Mini-Balance Evaluation Systems Test (Mini-BESTest) was developed to identify factors contributing to imbalance and may be a valuable measure for persons with multiple sclerosis (pwMS), as pwMS have impairments of various systems underlying balance control. To date, data supporting the use of the Mini-BESTest for pwMS is lacking. The purpose of this study was to determine the reliability, validity, and minimal detectable change (MDC) of the Mini-BESTest in pwMS.

Number of Subjects: 32

Materials/Methods: Individuals with MS were recruited through the Mid America Chapter of the MS Society. In the first session demographic data was collected and each subject completed a questionnaire of disease severity, the Activities-specific Balance Confidence Scale (ABC), and the Mini-BESTest. The Mini-BESTest was administered by two trained raters. The Mini-BESTEST was re-administered by one of the previous raters one week later at the same time of day.

Results: 32 ambulatory subjects with MS (mean disease severity = 3.6; range 0-7) participated. Inter-rater reliability of the total Mini-BESTest was ICC = 0.98 with subscales ranging 0.92 (reactive) to 0.97 (gait). Test-retest reliability for the total Mini-BESTest was ICC = 0.97 with subscales ranging 0.85 (anticipatory) to 0.92 (gait and sensory). Internal consistency among the 4 subscales of the Mini-BESTest was Chronbach’s alpha = 0.89. The MDC score for the total Mini-BESTest was 3.74; subscale MDC scores were 1.43 (anticipatory), 1.90 (reactive), 0.98 (sensory), and 2.38 (gait). Spearman correlation coefficients relating individual subsection scores to the total Mini-BESTest ranged 0.82 (reactive) to 0.93 (anticipatory). Correlations between individual subsections were moderate, ranging 0.65 (anticipatory to reactive) to 0.83 (anticipatory to gait). Correlations between the Mini-BESTest (total and subsections) and disease severity and ABC scores were moderate, but weak when related the number of falls in the past 6 months. No significant floor effects were found. Significant ceiling effects were found for all subsections (ranging 15.6% for anticipatory and gait to 53.1% for sensory). No significant ceiling effect was found for the total Mini -BESTest.

Conclusions: The Mini-BESTest is a reliable and valid test in pwMS. Moderate correlations among individual subsection scores indicate that each assesses a unique aspect of balance, supporting its construct validity. The ceiling effects for subsections may reflect the high functioning subjects and variability among subjects in various aspects of balance performance.

Clinical Relevance: The Mini-BESTest is a reliable and valid measure for use in ambulatory pwMS. The MDC scores will enable PTs to assess the treatment effectiveness. Total Mini-BESTest scores demonstrated higher reliability and a lack of a ceiling effect as compared to subsection scores, suggesting that PTs use the Mini-BESTest in its entirety.
TITLE: Visual World Tilt, Vertigo and Imbalance in a Young Woman with Suspected Unilateral Utricular Hypofunction

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ABSTRACT BODY:

Background & Purpose: Semicircular canal damage is often the cause of peripheral vestibular disorders. Unilateral utricular hypofunction has been reported in the absence of canal dysfunction with resultant dizziness, tilt illusion and postural imbalance. Patients with unilateral utricular abnormalities have greater postural instability and swaying sensations than those with canal damage, impacting functional mobility and performance of functional roles. The purpose of this case study is to describe the presentation, PT diagnosis and treatment of a patient with unilateral utricular hypofunction.

Case Description: A 24 year old female with history of migraine had sudden onset of left visual world tilt with dizziness, imbalance, inability to walk, perform self care, child care, drive or work. Work up including CT and MRI scans of the brain, CTA, MRA and blood work was negative. VNGs performed were WNL for canal and oculomotor function. Otolith testing was not performed. She was referred to vestibular PT. Evaluation in PT was normal for oculomotor and VOR screen. Position testing for BPPV was negative for all 6 canals. Subjective Visual Vertigo using a Static Bucket test demonstrated a left deviation of 10° off vertical. Significant fall risk was identified on the Functional Gait Assessment. Patient required maximal assistance for all functional mobility. Vestibular rehabilitation focused on balance training with decreased reliance on vision, functional mobility training, and habituation for head and body movements.

Outcomes: FOTO score increased from 21 to 100% at discharge. Headache decreased from 2/10 to 0/10. Activities of Balance Confidence score improved from 0 to 100%. Dizziness Handicap Index of 80% at evaluation indicating severe perception of handicap due to dizziness was reduced to 0%. Her mean gait speed self-selected velocity increased from 0.65'/s to 4.2'/s, and rapid gait speed from 0.0'/s (unable) to 5.5'/s. Functional Gait Assessment improved from 8/30 to 26/30. She was independent for all functional mobility. Patient was able to return to work, driving and all premorbid activities without symptoms.

Discussion: Unilateral utricular hypofunction may explain normal VNG results in patients with dizziness, balance and mobility impairment. Otolith anatomy and physiology and complex neurological interconnectedness is a likely cause of symptoms and prolonged recovery following damage or infection of the labyrinth. As the primary vestibular contributors to postural control, otolith organ input activates antigravity postural control muscles and moderates tone of the extensor muscles of the neck, trunk and lower extremities. Unilateral utricular hypofunction can be present in a patient with intact canal function and oculomotor testing, causing significant symptoms of vertigo, imbalance and severe functional impairment. Testing in PT with a static bucket identified a left utricular hypofunction. Vestibular rehabilitation can improve outcomes and reduce severity of disability in patients with unilateral utricular hypofunction.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Feasibility and benefits of an adapted Pilates program for individuals with Parkinson’s disease

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Purpose/Hypothesis: Individuals with Parkinson’s disease (PD) have decreased trunk movement during gait. Pilates exercise enhances control and mobility of trunk and pelvis musculature in older adults. Similar mind-body exercises such as yoga, Tai Chi, Feldenkrais Method, and Alexander Technique have shown beneficial effects on motor symptoms of people with PD such as increased trunk mobility and balance. However, no studies examine the effects of Pilates intervention on individuals with PD. The purpose of this study is to determine if an 8-week mat-based modified Pilates program will improve axial rigidity in individuals with Parkinson’s disease.

Number of Subjects: Eleven individuals with Parkinson’s disease with an average age of 65 years.

Materials/Methods: A modified 8-week Pilates intervention was taught by a certified Pilates instructor for 60-minute weekly sessions. A total of six outcome measures were taken at 3 time points: baseline, post-intervention, and 1-month post intervention. The outcome measures were selected to cross six domains of function: the instrumented Timed Up and Go (iTUG) for functional mobility, MDS-UPDRS for disease rating, Kings Parkinson Pain Scale (KPPS) for perceived pain, Patient Specific Functional Scale (PSFS) for self-reported functional activity rating, Patient Disease Questionnaire-39 (PDQ-39) for quality of life, and Five Times Sit-to-Stand for functional strength.

Results: Significant improvements were found for iTUG duration (p=0.044), PDQ-39 (p=0.001), PSFS (p=0.035), and the KPPS (p=0.001). None of the spatiotemporal gait measures during the iTUG differed across time points (p>0.05). The KPPS and PDQ-39 improvements were retained at one month after the conclusion of intervention.

Conclusions: This study suggests that an 8-week mat-based Pilates intervention modified for patients with Parkinson’s disease is a feasible and effective way to improve quality of life and functional outcomes as well as reduce pain.

Clinical Relevance: Clinicians can confidently recommend mind-body awareness type exercises such as Pilates to help their patients with Parkinson’s disease manage their symptoms, improve their quality of life, decrease their pain levels, and improve their ability to perform functional daily tasks.
TITLE: The integration of virtual reality goggles & free roller coaster phone app in the management of a pregnant woman with vestibular neuritis: A case report

AUTHORS/INSTITUTIONS: J.D. Ries, Physical Therapy, Marymount University, Fairfax, Virginia, UNITED STATES| B. Bass, Alliance Physical Therapy, District of Columbia, District of Columbia, UNITED STATES|

ABSTRACT BODY:

Background & Purpose: In an intact vestibular system, the left & right vestibulocochlear nerves (CN VIII) transmit complementary information about head posture/movement and balance to higher brain centers giving a clear & accurate sense of head position & movement. In unilateral pathology, such as vestibular neuritis (VN), a discrepancy of data coming from left vs right may cause the patient to experience imbalance, vertigo, dizziness, nausea, &/or visual complaints. A component of progressing rehab for VN includes providing opportunities to resolve conflicting afferent information (i.e., visual, vestibular, somatosensory) within the balance integration system. Virtual reality (VR) technology can provide excellent rehab opportunities, but to date there is only published evidence of extensive VR labs or home gaming systems used for this purpose.

Case Description: The patient, a 35-year-old female, 14 weeks pregnant, experienced insidious onset dizziness. Work up by ENT & neurologist led to diagnosis of VN with “possible permanent damage.” Prior level of function was total independence, including full-time desk job using computer monitor. Upon PT exam, she was unable to sit unsupported, stand or walk independently. She was unable to work and was fearful of falling, especially given 2nd trimester pregnancy. Interventions (10 visits over 34 days) included: (1) Training with cane for safety; (2) Progressive habituation activities; (3) Progressive gaze stabilization activities; (4) Progressive narrowing of base of support & dynamic challenges in increasingly challenging environments; (5) VR goggles & roller coaster app, chosen specifically to provide sensory mismatch & address complaints of balance challenges in moving environments; (6) Home exercise program. Safety was prioritized with gait belt & contact guard during all activities.

Outcomes: Patient progressed steadily in time & intensity of all exercise interventions. She showed no evidence of cyber-sickness related to VR training. At re-evaluation on 10th visit, patient was able to sit, stand, & walk independently and had returned to work, tolerating 5 hrs/day of screen time. Persistent challenges included walking in crowded or dark environments. Outcome measures included: (1) Dizziness Handicap Inventory improved from initial score of 96 to 16 (Function 36 → 6, Emotion 32 → 0, Physical Aspects 28 → 10); (2) Tandem stance, tandem gait & single limb stance tests (SLST) improved from initial inability to perform to SLST x 3 sec on right & 4 sec on left; (3) Cervical spine strength improved from grossly 2-/5 to 2+/5; (4) Nystagmus & difficulty with convergence upon initial exam resolved over time.

Discussion: This case demonstrates the unique use of inexpensive & accessible VR goggles and a free phone app as a component of successful rehab, specifically for providing opportunities for resolving sensory mismatch in the management of unilateral VN. VR as a component of vestibular rehab need not require extravagant & expensive equipment.

How do you rehabilitate balance when vision, sensation, and vestibular systems are impaired? A case study.

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Background & Purpose: Vascular hemorrhages make up 13% of all strokes, with only 4%-9% located in the brainstem. In the acute rehabilitation setting, studies have reported sub-tentorial stroke occurrence in 15% of all stroke patients. There are few studies addressing the rehabilitation of these patients. This limitation may be due to the high heterogeneity of symptoms in patients with brainstem strokes. Despite multiple reported syndromes, common impairments include hemiparesis, ataxia, diplopia, dysarthria, dysphagia, and balance dysfunction. There is sparse literature available on Physical Therapy (PT) treatments for balance recovery in patients with posterior pontine hemorrhage. Thus, the purpose of this case report is to describe a successful PT intervention for recovery of balance in this patient population.

Case Description: The patient, T.P. was a forty-nine-year-old male who presented to an acute rehabilitation hospital with a dorsal-medial pontine hemorrhage. T.P. had absent sensation to light touch in his right upper and right lower extremities, ataxic movements in bilateral upper and lower extremities, diplopia, nystagmus, and abducens nerve palsy. Additionally, T.P. had absent proprioception in the right upper extremity to the shoulder and the right lower extremity to the knee. T.P.’s rehabilitation was complicated by hypertension, which caused one readmission to an acute medicine unit for 7 days. While inpatient rehabilitation, T.P. received multidisciplinary care, which included PT, Occupational Therapy, Speech Language Pathology, Recreation Therapy, and Neuropsychology. PT interventions included a walking program, which was comprised of overground and treadmill walking in a variety of directions. Outcomes were administered at admission and weekly for 4 weeks thereafter. Outcome measures assessed were the Activity Measure for Post-Acute Care (AMPAC) 6-clicks, the Functional Independence Measure Motor Sub-score (FIMmotor), the Postural Assessment Scale for Stroke (PASS), and the Berg Balance Scale (BBS).

Outcomes: Improvements were noted in all outcome measures at each time point. An improvement of 18 points on the PASS from admission to discharge (MCD=2.22), and a 19-point improvement on the BERG from week 1 to discharge (MCD=6.9), indicated a statistically significant change in balance. Improvements were also noted in right sided position sense in all joints, and T.P. reported improvement in light touch sensation on testing. T.P. was discharged home with a rolling walker, 24-hour supervision from his family, and contact guard assistance when ambulating and performing stairs.

Discussion: This case report reviews the rehabilitation of a patient with a posterior pontine hemorrhage, who experienced light touch impairment, proprioception loss, and ataxia. As T.P.’s performance improved across all outcome measures, he was successfully discharged to home. The walking program utilized was found to be advantageous for the rehabilitation of a patient with impairments in all dimensions of balance.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

**Background & Purpose:** The use of an assistive device (AD) is common in individuals with Parkinson’s Disease (PD) with moderate impairments in gait and balance. Deep Brain Stimulation (DBS) is an option for those who have chronic PD to decrease motor symptoms and levodopa dependence. It is estimated that about 60% of individuals with PD have at least one fall and nearly 40% have recurrent falls. Cognitive impairments and the inability to properly coordinate the use of an AD during a movement pattern can predispose individuals to falls. The purpose of this case report is to discuss the implications of the removal of an AD during gait further improving balance and decreasing fall risk in an individual with PD and bilateral DBS.

**Case Description:** A 59 year old male with PD and bilateral DBS presented with increased falls, decreased activity tolerance, and increased freezing of gait (FOG). Examination revealed dyskinesias of the head/trunk and right side of the body. Gait assessment demonstrated poor coordination with a cane, festinating gait, and occasional FOG. Over the course of 10 visits in 4 months, gait retraining was performed with emphasis on compensatory stepping strategies without an AD in attempts to reduce FOG and improve turning and step initiation. Gait adaptability was addressed with dynamic balance activities without the cane to challenge postural muscle control and reactions, start/stop strategies, and activity tolerance.

**Outcomes:** The Timed Up and Go (TUG) test, used to assess quality of gait with turns, increased from 5.78 seconds (s) using a cane to 9.84 s without a cane. Gait speed measured via the 10 Meter Walk Test (10MWT) increased from 9.70 s (1.03 m/s) with the cane to 13.0 s (0.76 m/s) without the device. Perceived confidence and likelihood of recurrent falls, assessed by the Activities-specific Balance Confidence (ABC) Scale, remained similar for ON medication time, however, decreased to 21.9% from 33.13% during OFF medication. Over the course of 10 visits in 4 months, self-reported falls decreased from daily to 0-5 falls a week.

**Discussion:** The patient demonstrated a slower gait speed and walking ability with fewer incidences of falls at home upon completion of the therapy sessions despite previous research indicating that slower walking ability is linked to an increase in fall risk. Previous research has also indicated that individuals with PD who walk with an AD, have decreased gait speed. The patient reduced his self-selected walking speed without the AD which ultimately increased time to perform the 10MWT at a comfortable speed and TUG time. The use of a cane in PD with DBS interfered with limb/step coordination during gait leading to an increased fall risk. Slower gait speed and removal of the cane led to a decrease in the number of falls reported over a 4 month period.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

persistent positional nystagmus in a patient with a central vestibulopathy acutely mimicking Meniere's disease and benign paroxysmal positional vertigo: a case report

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abstract body:
background & purpose: dizziness and vertigo are common complaints of those seeking emergent medical attention. nearly half of those patients later require revision of their diagnosis making accurate examination an important task for the medical provider. the purpose of this case report is to describe the examination findings that assisted with the diagnosis of a central vestibulopathy in a patient previously treated unsuccessfully for meniere's disease and benign paroxysmal positional vertigo. furthermore, this case report will also outline the interventions that led to objective improvements over the course of care.

case description: a 57 year old male presented to outpatient vestibular rehabilitation complaining of constant dizziness, unilateral aural symptoms, intermittent diplopia and frequent falls for greater than 15 months. the patient's symptoms interfered with daily activities and he required a cane for ambulation. the patient was treated for six visits over 12 weeks with vestibular adaptation, saccadic substitution, habituation exercises and balance training.

outcomes: during the course of care, the original diagnosis was amended to a non-specific central vestibular disorder. at discharge, the patient improved in objective tests of balance and gaze stability, subjective assessments of dizziness and motion sensitivity, and ambulation without an assistive device, while decreasing falls frequency. the following outcome measures showed an improvement from baseline measurements at discharge from vestibular rehabilitation: the functional gait assessment (fga) improved from 15 to 25/30, dynamic visual acuity (dva) testing showed a two line improvement from a four to a two line difference, sharpened romberg improved from 4 to 39 seconds, single limb stance (sls) improved from 10 to 18 seconds and 19 to 33 seconds on the right and left sides respectively, and the motion sensitivity quotient (msq) was reduced from a raw score of 32 to 22/132. although the dizziness handicap inventory (dhi) improved by a margin less than the established mcid of 18 points, the improvement from 68 to 58/100 indicated a transition from severe to moderate perception of dizziness related handicap. in addition, this patient reported a verbal analog rating of vertigo intensity of 0/10 during all daily activities and positional testing at the cessation of therapy. since symptom onset, this patient had been unable to work as a result of his symptoms; following discharge this patient was actively searching for employment secondary to the improvement in dizziness, balance, and function.

discussion: the ability to perform a thorough clinical examination and utilize appropriate diagnostic criteria likely would have facilitated accurate diagnosis at symptom onset. application of current literature and evidence-based protocols aided in clinical decision-making throughout this case allowing the patient to return to near baseline function after 12 weeks of customized vestibular rehabilitation.

references: limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
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gold dr, morris l, kheradmand a, schubert mc. repositioning maneuvers for benign paroxysmal positional vertigo.


Title: Accuracy of bedside examination for balance impairments: Finding the best screening assessments as an alternative to Berg Balance Scale.

Authors/Institutions: Y. Xia, K. Siu, Physical Therapy Education, University of Nebraska Medical Center, Omaha, Nebraska, United States; R. Thompson, D.E. Bhatti, A. Hellman, D. Torres-Russotto, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, Nebraska, United States; J. McKune, K. Suing, L. Schmaderer, Nebraska Medicine, Omaha, Nebraska, United States.

Abstract Body:
Purpose/Hypothesis: Balance impairments are prevalent in the general population, and can increase fall risk. Although Berg Balance Scale (BBS) is a well-validated and popular tool for balance assessment among physical therapists (PTs), it is lengthy, time-consuming and requires the scale in hand for reference. In our practice, PTs could choose different balance screening assessment tools for bedside examination, such as standing unsupported with eyes closed to quickly evaluate balance impaired patients. However, the accuracy parameters (sensitivity, specificity, etc.) of those screening assessments are largely unknown. Our study aimed to reveal the validity of widely used bedside balance examinations, using BBS as gold standard.

Number of Subjects: Sixty-five subjects participated in the study. Forty-four of them had complaints of balance impairment, and 21 were spousal controls without imbalance complaints.

Materials/Methods: Subjects were evaluated by multiple bedside balance examinations, which were commonly used among neurologists and/or PTs, including truncal sway, UPDRS-raising (from the Unified Parkinson’s Disease Rating Scale), stance base, standing with feet close eyes closed/open, standing with feet apart eyes closed/open, line of ambulation, tip-toe walking, tandem walking, UPDRS-pull test, unipedal jumping, BARS-gait (from Brief Ataxia Rating Scale). Bedside examinations were conducted and graded by physicians, and the BBS was administered by blinded PTs as gold standard. The screening ability of each bedside test (alone or in combinations) was calculated using the BBS cut-off point of 45. We applied two-sided independent samples t test and Mann-Whitney test in demographic description of subjects.

Results: The average age of subjects was 69.37±9.51 years old (range 32-87). There was no difference on age distribution between the two groups (BBS≤45 vs. BBS>45; p=0.083, α=0.05). Forty-six participants had a normal balance performance by BBS, while 19 had balance impairment (true positives). High-sensitivity tests (over 90%) included: stance base, standing with feet close eyes closed/open, standing with feet apart eyes closed/open, standing with feet close eyes open, general gait, pull test, 10-hop unipedal jump. High-specificity tests (over 90%): truncal sway, UPDRS-raising, and the pull test. The combined procedure of 3-hop unipedal jumping and pull test (failed in either one counted as balance impairment) showed 89% sensitivity and 83% specificity.

Conclusions: The best bedside screening assessments for imbalance include pull test, BARS-gait, standing with feet apart eyes closed, and 10-hop unipedal jump (each with a sensitivity over 95%).

Clinical Relevance: Those quick, bedside screening assessments are widely used but remain unknown in validity. This study measured the concurrent validity, compared to BBS to support our choice in the clinical practice. In some certain situations where BBS is not available or applicable, the best bedside screening assessments in this study can be an alternative for a preliminary evaluation.
TITLE: Does Hands-on Guarding Influence Performance on the Functional Gait Assessment?

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ABSTRACT BODY:

Purpose/Hypothesis: Fall prevention is critical for preserving the health and independence of older individuals. Upon initial examination by a physical therapist (PT), it may be difficult to determine the type of guarding assistance required for safety during balance and gait assessments. Although light touch facilitates stationary balance, it is unknown if contact guard assistance, with a hand on the gait belt, has a significant effect on dynamic balance and gait assessment outcome measures. The purpose of this study was to determine the effects of Stand By Assistance (SBA) and Contact Guard Assistance (CGA) on Functional Gait Assessment (FGA) scores among community-dwelling older adults. We hypothesized that: 1) there would be no significant difference between FGA scores during the different guarding conditions as scored by experienced PTs and 2) participants would not be aware of any differences between both trials of the FGA.

Number of Subjects: 23

Materials/Methods: Twenty-three community dwelling older adults, age 55 years or older (mean age = 73.6 ± 6.2, Male = 6, Female = 17), participated in this study. Participants had no reported history of neurological disorders, and if they had chronic medical conditions, they were well controlled. All participants completed two trials of the FGA and were video recorded. A two minute rest period was provided between each trial. Participants were randomly assigned to begin with one of two conditions: CGA - guarded with a hand on the gait belt and SBA - guarded without touching the gait belt or participant. An experienced PT with 19 years of clinical practice guarded participants on both trials. Two PTs (raters) with greater than five years of clinical practice, blinded from the purpose of the study, scored the FGA videos.

Results: Results indicated high internal agreement between raters (CGA: ICC = .949, SBA: ICC = .935). Further analysis was conducted by averaging the scores to assess differences in scores based on the level of assistance provided. No significant differences were found. A paired samples t-test was used to compare the sum of CGA with the sum of SBA (based on average scores of two raters that were summed to create totals). CGA ratings did not differ from SBA ratings, t(22) = 0.15, p = .882. Additionally, participants reported no perceived differences between the two trials. Three participants perceived improved performance on the second trial due to familiarity with the task.

Conclusions: These results are consistent with the hypothesis that there would be no significant difference between FGA scores. Using CGA did not significantly change the FGA score when compared to SBA. The majority of the participants were not aware of any difference between both trials of the FGA.

Clinical Relevance: An experienced PT may use CGA to ensure patient safety when administering the FGA with this patient population without a significant influence on the FGA score.
TITLE: Implementation and Patient satisfaction of a multidisciplinary Parkinson’s disease clinic

AUTHORS/INSTITUTIONS: K. Miesbauer, R. Peter, G. Lev, University of Colorado Health, Aurora, Colorado, United States

ABSTRACT BODY:

Purpose: Describe the creation and implementation of a multidisciplinary Parkinson’s disease (PD) clinic in a hospital setting.

Report results of a patient satisfaction survey for this clinic.

Description: a. Parkinson’s disease is a progressive neurodegenerative disorder which causes impaired motor and non-motor symptoms. Early identification and treatment of impairments and functional limitations can improve patient outcomes and disease management. In order to identify and track changes in functional performance related to PD, we created a multidisciplinary clinic that included Physical Therapists (PT), Occupational Therapists (OT), Speech Language Pathologists (SLP), and movement disorder neurologists.

b. The clinic format was designed to minimize inconvenience to the patient. The total time obligation was 2 hours, allowing 30 minutes per discipline. Each patients’ functional performance was measured with evidence based and patient centered tools. A customized note was created in the electronic medical record (EMR) that allowed each discipline to document outcomes, assessment, and recommendations in real time. The findings and recommendations were embedded into the neurology summary note to enhance the review and application of important clinical data.

c. To understand patient satisfaction with the clinic, we created a satisfaction survey graded on a Likert scale.

Summary of Use: One hundred seventy seven individuals were evaluated in the PD clinic between April 2015 and February 2017. Median participant age was 65 +/- 8.7 years old. The time between PD diagnosis and clinic evaluation ranged between 1 to 16 years (median 5 years). Thirty three individuals (19%) completed satisfaction surveys. Average ratings for each question ranged from 1.0 to 1.3; the highest ranked category being the ability of each discipline to address patient questions and concerns. The average rating for the question of whether the clinic helped patients better manage their disease was 1.2. In general, participants indicated strong agreement with satisfaction in all categories.

Importance to Members: Implementing a multidisciplinary PD clinic in an EMR capable academic medical center is feasible, as our clinic has been successfully operational for 2 years. Additionally, patients were highly satisfied with this model of care and perceived improved disease management.

We believe a well-timed, efficient, and standardized clinic model were essential components of this unique clinic. This, coupled with customized EMR documentation allowing for real time clinical application of data were keys to successful implementation of the clinic.

Limitation of this report are 1. The patient satisfaction survey utilized is not a validated instrument and only 19% of participants returned a completed survey. 2. We did not compare our clinic’s ability in improving disease management to the standard of care. Further objective measurement of disease management would provide insights into the impact of this approach on the quality of life and overall health of individuals living with PD.
TITLE: Serratus Anterior Muscle Activity During Exercises for Individuals with Paraplegia


ABSTRACT BODY:

Purpose/Hypothesis: Serratus anterior (SA) strengthening is commonly featured in able-bodied programs for prevention and rehabilitation of shoulder pain. Emphasis on SA activation, while simultaneously limiting upper trapezius (UT) activation, is critical to guide optimal scapular kinematics (posterior tilt, upward and external rotation) during shoulder elevation. Through exercises such as the push-up plus, researchers have successfully demonstrated a balance between UT and SA activation. Of note, shoulder pain is even more prevalent in the spinal cord injury (SCI) population with up to 67% of individuals with paraplegia having a history of shoulder pain. However, exercise positions such as the push-up plus are not always feasible for individuals with paraplegia. The purpose of our study is to determine which exercises effectively activate the SA, as well as determine which exercises maximally activate the SA while minimizing UT activation. We hypothesize 1) dynamic hug will have the greatest SA activation and 2) SA punch will optimize the UT/SA ratio.

Number of Subjects: Convenience sample of five manual wheelchair users with paraplegia and non-painful shoulders (ages 45-61, 3 males and 1 female, AIS motor levels T4-T12 and 1 male, spastic hereditary paraparesis).

Materials/Methods: Instrumentation: 16-Channel Trigno Wireless EMG and 11-Camera Vicon Motion Capture were used to collect EMG and kinematic data. Procedures: Simultaneous EMG and kinematic data were collected during two seated exercises (T and scaption) and two supine exercises (dynamic hug and SA punch) performed below 90° of humeral elevation. Paced by a metronome, eight repetitions of exercises were performed at 60% of the one-repetition maximum. Analysis: Data were normalized using muscle activation reported as percent maximal voluntary isometric contraction (%MVIC). Means and standard deviations were determined for the normalized EMG values for each muscle and the UT/SA ratio from the concentric phase of the exercises.

Results: The greatest SA activation occurred during SA punch (74.9±27.1% MVIC), with Scaption, Dynamic Hug, and T producing 68.5±22.4, 33.7±10.6, and 16.2±10.5% MVIC, respectively. SA punch also demonstrated the lowest UT/SA ratio at 0.08, with ratios for Dynamic Hug, Scaption and T exercises of 0.16, 0.97, and 4.77, respectively.

Conclusions: Contrary to our first hypothesis, the SA punch had the greatest SA activation. Supporting our second hypothesis, the SA punch also produced the most optimal UT/SA ratio.

Clinical Relevance: In individuals who rely on their upper extremities for independence, it is critical to minimize shoulder pain. SA punch promotes improved SA activation, and as part of a comprehensive rehabilitation program, may help decrease shoulder pain. The supine position used in SA punch offers trunk stability and limits excessive UT activation. Although scaption offers similar SA activation, there is limited stabilization in the seated position, resulting in excessive use of the UT. Future research should explore the use of the SA punch in reducing shoulder pain in individuals with paraplegia.
ABSTRACT BODY:

Purpose/Hypothesis: Individuals with neurologic disorders often present with functional deficits in ambulation, balance, and activities of daily living. Often these individuals require an ankle-foot orthosis (AFO) to improve walking ability, safety and functional independence. However, many patients are non-compliant with wearing the AFO after discharge. The aim of this study was to investigate factors that influence the compliance with use of AFOs in the neurologic population.

Number of Subjects: Thirty adults with neurologic deficits who had used an AFO greater than three months and were previously physical therapy patients were included. The average age of participants was 48 years, and included 16 females. Diagnoses included stroke, spinal cord injury, head injury, peripheral nerve disorders, multiple sclerosis, cerebral palsy and a tumor. Six treating physical therapists were also included in the study, with years of experience ranging from four to greater than 30 years. Five hold an advanced certification.

Materials/Methods: Subjects were administered a 27 question survey regarding the use or non-use of an AFO, as well as their functional mobility status and confidence in the home and community. Subjects were divided into two groups based on their reported continued use or non-use of their AFO. Treating therapists were surveyed to determine their perception of the necessity of AFO use for each participant.

Results: The frequency in which patients had modifications to their AFOs following prescription was significant in compliance with AFO use. Those who remained compliant had an average of 2.06 modifications, while the average number of modifications for those who discontinued use was less than 0.5. There was no significant difference in AFO compliance based on diagnosis, time since prescription, or number of falls. Patients most frequently reported discontinuing use due to their perception of decreased necessity, increased dependence on caregivers for donning their AFO, and the AFO no longer fitting well. Skin integrity or cosmetics factors were not cited for non-compliance. Twelve patients had differing perceptions of importance of use compared to therapists. Ten of these patients were in the non-compliant group.

Conclusions: These findings suggest the need for increased intervention by the physical therapist and orthotist following initial prescription of an AFO. Specifically, those with congenital disorders and with chronic acquired conditions should have annual or biannual evaluations with a physical therapist to assess appropriateness of the device and necessity of modifications.

Clinical Relevance: Research regarding compliance with long-term AFO use is limited and is focused on influences of skin integrity and cosmetic factors. Further study regarding factors influencing compliance with AFO wear will improve therapist clinical decision making during assessment for AFOs. With improved patient education and shared decision making, patients will likely demonstrate improved compliance with AFO wear and ultimately better functional mobility.
Balance and Verticality Training in a Patient Following an Acute Anterior Inferior Cerebellar Artery Stroke

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Background & Purpose: People with an anterior inferior cerebellar artery (AICA) cerebral vascular accident (CVA) commonly present with unilateral hearing loss, vertigo, nystagmus, and falling toward the side of lesion with altered perception of vertical. While some evidence demonstrates how to measure verticality in patients following an AICA CVA, there is very limited evidence available to guide physical therapy (PT) interventions for correction of verticality. However, there is some evidence demonstrating the effectiveness of PT for patients with pusher syndrome who demonstrate an altered sense of vertical due to a cerebral CVA. This case study highlights the application of best available evidence, including visual cues and computer-generated feedback, to improve balance and verticality in a patient with an acute AICA CVA.

Case Description: A 67-year-old male was admitted to an inpatient rehabilitation facility (IRF) following an acute left AICA CVA with profound postural control deficits and altered sense of verticality. The patient required total assistance for transfers and bed mobility, was non-ambulatory and unable to sit unsupported. PT interventions included verticality training in combination with postural control activities over the course of the initial 9 days of rehab. Postural control interventions focused on increasing degrees of freedom in varied postural positions including supine, supported sitting, unsupported sitting and standing. Verticality training included visual cues with a mirror and external vertical visual targets with progression to use of a computer-generated feedback system. The computer-generated intervention focused on improving the patient’s ability to correct and maintain an upright posture in sitting and standing with immediate external feedback to assist with motor learning.

Outcomes: Berg Balance Scale (BBS), Trunk Impairment Scale (TIS), Functional Independence Measure (FIM) and Stroke Rehabilitation Assessment of Movement Measure (STREAM) were performed at evaluation and 9 days later. BBS improved from a 0/56 to a 5/56. TIS improved from a 0/23 to 9/23 (MDC not established in acute stroke), indicating improved sitting balance. STREAM score did not improve. FIM score for bed to chair transfer improved from 1 to 3, indicating a significant reduction in burden of care.

Discussion: Improvements in this patient’s postural control and sense of verticality suggest a benefit of using external visual targets in combination with computer-generated feedback training. Impaired verticality and poor balance can significantly limit the safety of progression of functional mobility tasks. Addressing verticality early in the rehabilitation phase may allow for faster progression of functional mobility training and optimize functional outcomes. Clinicians treating in the IRF setting may consider application of this treatment approach in patients with acute AICA stroke and altered sense of verticality to improve postural control.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Effects of visual feedback on muscle recruitment and retention of force production during recumbent stepping in individuals with stroke

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J. Caldwell, S. DeAngelo, A. Rohkohl, A.M. Swadling, S. Galen, Physical Therapy Program, Wayne State University, Detroit, Michigan, UNITED STATES

Purpose/Hypothesis: The NuStep recumbent stepper is widely used by clinicians to improve cardiovascular health and physical performance. There is currently no evidence on the effects of visual feedback (VF) on muscle activation and force production when exercising on the NuStep, and if VF can translate to a more symmetrical gait pattern. The purpose of this study was to investigate changes in electromyographic (EMG) activation and force production while exercising with and without VF in subjects with chronic stroke, and any carryover effect it may have on symmetry of gait.

Number of Subjects: Thirteen participants (9 female, 8 right hemiparesis, mean age 61.6 ± 14.0 years) with chronic stroke were recruited from the metro Detroit area.

Materials/Methods: Participants completed three 10 meter walks wearing wireless gait assessment tool (Wi-GAT) insoles to record spatiotemporal gait parameters at the start and end of this single visit study. EMG surface electrodes were applied to the rectus femoris (RF), vastus medialis (VMO), semitendinosus (ST), soleus, medial gastrocnemius, and tibialis anterior (TA) muscles bilaterally. The force and EMG output during maximal voluntary contraction (MVC) of each muscle were measured simultaneously using surface EMG and hand-held dynamometry. Participants performed 3 bouts of 5 minutes of stepping with a 5 minute rest in between conditions (VF, no VF, and VF). EMG data were recorded at 10 second intervals during the 2nd, 3rd and 4th minutes of each condition and were normalized to MVC. A descriptive analysis was performed followed by a repeated measures ANOVA to examine differences in muscle activation between experimental conditions, hemiparetic side, and muscle groups.

Results: There were significant differences in muscle activation while stepping (p<0.0001) regardless of VF. The left VMO had a greater activation than the RF and TA (p=0.004). The left soleus had a greater activation than the RF (p=0.013), gastrocnemius (p<0.0001) and ST (p=0.002). The right soleus had a greater activation than the RF (p=0.005) and ST (p=0.004). With VF, the left soleus activity increased further, significantly greater than RF, ST and gastrocnemius (p=0.001).

Conclusions: Stepping on the NuStep causes certain muscles (VMO and soleus in particular) to be activated preferentially. Although VF did not result in significant changes in muscle activation between conditions, subjects who generated more force on their unaffected side without VF had a symmetrical force production with VF (n=5, the others were closer to the optimal 50:50 stepping without VF). Gait indices showed a trend towards an improved swing to stance ratio after the training conditions.

Clinical Relevance: This preliminary study has demonstrated that VMO and soleus can be preferentially activated while exercising on the NuStep. The ability to improve the symmetry of stepping in the stroke population by using VF could be of interest to clinicians, who may want to include the NuStep as an intervention to encourage forced use of the unaffected side.
TITLE: Impact of Fatigue on Dual-Task Functioning in People with Stroke and Healthy Older Adults

AUTHORS/INSTITUTIONS: M. Roos, C. McVey, A. Clark, H. Murphy, T. Vo, D. Capers, L. Regan, E. Shvedov, Physical Therapy, University of the Sciences in Philadelphia, Wilmington, Delaware, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Individuals with stroke may have deficits in cognition1 and fatigue2 which can significantly impact on functional mobility3 which may be due to the higher energy cost as seen in ambulation4. The Timed Stair Test is a reliable measure of functional ability5 that can be more fatiguing than level surface ambulation. Outcome measures that quantify the impact of cognitive deficits during functional tasks in people with stroke are limited. Our purposes were to investigate the use of a timed stair test (STAIR) with a verbal fluency cognitive task (COGN) as an outcome measure in people with stroke, assess the impact of fatigue on cognition and function, as well as compare the results to those seen in healthy older adults.

Number of Subjects: 8 individuals with high level stroke (STROKE) and 7 healthy older adults (HEALTHY) have participated to date.

Materials/Methods: Subjects completed the Activities Specific Balance Confidence Scale (ABC), 17 step timed stair test (STAIR), COGN, and verbal fluency with timed stair test (COMBO). Subjects underwent clinical testing including the Timed Up and Go (TUG), TUGcognitive, and TUGmanual, 10 Meter Walk Test at self-selected (SS) and fast (FAST) speeds. Subjects then completed a 6 minute walk test (6MWT) while walking at moderate intensity (40-60% of target heart rate). If the verbal analog scale was not > or = 8/10 at conclusion of 6MWT, subjects then completed an additional 6MWT. Subjects then repeated STAIR, COGN and COMBO tests.

Results: There were no group differences in time to complete COMBO pre and post fatigue. Participants took significantly more time to complete COMBO pre and post fatigue (Stroke:p=.017, p=.024; Healthy: p=.018, p =.05, respectively) and made significantly more errors (both, p<.04). In STROKE at baseline,COMBO was significantly correlated with TUG (spearman rho (rs)=-.905, p=.002) and TUGmanual (rs=.866, p=.02), while in HEALTHY, COMBO correlated only with TUGcognitive (rs=.664, p=.05). ABC significantly correlated in STROKE(Spearman rho =.881, p=.002) but not in HEALTHY.

Conclusions: Having subjects complete a timed stair test with cognitive challenges can be difficult for those with stroke similar to deficits seen with dual task walking6. A timed stair test with an additional challenge of performing a cognitive task can highlight deficits in balance and mobility seen in those with stroke who are at a higher functional level which may be overlooked with walking measures completed on a level surface. The impact of fatigue on performing this dual task was significant in both STROKE and HEALTHY with greater time required and increased functional and cognitive errors.

Clinical Relevance: An outcome measure that can be used to document many deficits typically seen in people with stroke and which has a large ceiling effect can be useful to note changes seen through clinical interventions. The Timed Stair/Verbal Fluency may help therapists quantify deficits and highlight the impact of fatigue on function and cognition. Patients can be cautioned about potential challenges when stairclimbing at home.
TITLE: The effect of a divided attention task on gait velocity in high school male athletes

AUTHORS/INSTITUTIONS: L. Lowe, M. Crowder, T. Watson, C.C. Yates, Physical Therapy, University of Central Arkansas, Conway, Arkansas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: In order to prevent subsequent injury following a concussion, it is critical to identify functional impairments during the recovery period. Previous studies have found that adolescents and adults with both acute and chronic concussions have been shown to adopt a more conservative gait strategy than control subjects by decreasing their gait velocity during a dual-task effort. Normative data for gait velocity in adolescent males has not been defined. Furthermore, the typical cost to gait velocity when a dual task is introduced has not been defined in the literature for the uninjured adolescent male. The purpose of this study was to establish normative data on gait velocity for walking with and without a dual-task using the GAITRite® system in 15-17 year old male high school football players.

Number of Subjects: One hundred and thirty subjects in the 10th (n=50), 11th (n=40), and 12th (n=40) grades participated. Participants comprised 66 Caucasian males, 62 African American males, and 3 males who reported “other” for race.

Materials/Methods: Gait velocity was assessed by instructing athletes (n=130) to walk at a self-selected speed on the GAITRite® portable gait analysis walkway for three undivided attention trials and three divided attention trials. During each divided attention trial, a visual cognitive task, the Brooks’ Spatial Memory Task, was given to the subjects to complete on a tablet while walking.

Results: High-school male athletes participating in this study walked with a mean gait velocity of 1.236 m/s (SD 0.163). When walking with a visual, cognitive task, the mean gait velocity was 1.030 m/s (SD 0.185) indicating that, on average, the dual-task cost for these athletes was a decrease in gait velocity of 0.205 m/s (SD 0.140) (p= <.0001). These averages were further stratified by age to examine differences between groups. No significant differences were found (p=0.3263).

Conclusions: Normative data for gait velocity with and without a dual-task were established for male high school football players. Our study shows that a visual, cognitive task during walking creates, on average, a significant cost to gait velocity in the adolescent male.

Clinical Relevance: Increased risks for subsequent injury following concussion could be linked to deficits in dynamic balance and control. Furthermore, these impairments may be most easily noted using a dual-task paradigm that more closely mimics the demands of athletic play. This study provides necessary baseline values in uninjured athletes that allow for comparisons in concussed individuals when making rehabilitative or return to play decisions.
Purpose/Hypothesis: The goal of this study was to evaluate the TUG and TUGcog and correlations with other frequently measured outcomes in a population with Parkinson’s disease (PD).

Number of Subjects: 28 subjects (mean age 74.3 ± 6.5 yrs; 19 male/9 female; BMI 28.6 ± 5.7) participated.

Materials/Methods: Subjects attended a 12 week physical activity program 2x/week for 60 minutes each session. Outcome measures were assessed at baseline and after completion of the program. Outcomes included the TUG, TUGcog, Functional Gait Assessment (FGA), 5 times Sit to Stand Test (5xSST) and 6 Minute Walk Test (6MWT). Paired t-tests were used to assess change in outcome measures. Reliability coefficients were determined for TUG and TUGcog at baseline and conclusion of program and with other outcome measures (SPSS, vs 24).

Results: Paired t-tests showed a significant change from baseline to completion for both the TUG (-1.2 sec ± 1.9; p=0.002) and TUGcog (-1.4 sec ± 2.7; 0=0.01); and no difference between tests. Differences between baseline and completion were also noted for the 6MWT (p=0.02), FGA (p<0.001), and 5xSST (p<0.001). There were strong correlations between the TUG and TUGcog at baseline and completion (r>0.9). Both the TUG and TUGcog demonstrated similar strong correlations for FGA (-.88, -.89), 6MWT (-.78, -.68), and 6xSST (.76, .63) at the end of the program.

Conclusions: The strong correlation values between TUG and TUGcog, along with the significant change in scores over the course of the program, indicate that both tests are useful to track progress in a population with PD. Convergent validity is demonstrated by strong correlations between the two versions of the TUG and the FGA, 6MWT, and 5xSST. Cognition was not assessed in this community population and is a limitation.

Clinical Relevance: This supports the concept that the TUG and TUGcog may be appropriate measures of dynamic balance, endurance and lower limb muscle strength, but both are not required concomitantly.
Background & Purpose: It is estimated that 1.6 to 3.8 million concussions occur yearly in the United States with an estimated 50-80% of these cases sustaining vestibular and/or ocular dysfunction. Vestibular-ocular deficits include: vestibular ocular reflex (VOR) dysfunction, impaired postural control, accommodative disorders, convergence insufficiency, saccadic dysfunction and ocular misalignments. Recovery typical occurs within a 7 to 10 day window although persistence of symptoms can lead to Post Concussive Syndrome (PCS) and warrant physical therapy intervention. There is no current evidence demonstrating the effectiveness of delivering needed physical therapy services to these patients using the internet i.e. tele-rehabilitation. The purpose of this case study is to evaluate the effectiveness of physical therapy services delivered via tele-rehabilitation to a patient with PCS who had no access to an onsite physical therapist specializing in vestibular-ocular rehabilitation.

Case Description: 21 year old female lacrosse player with a 2 month history of post concussive symptoms including: daily headaches, difficulty concentrating, difficulty with vision and poor academic performance. Treatment prior to initiation of tele-rehabilitation included cognitive and physical rest for 7 weeks with daily check-ins with Athletic Trainer (AT) and completion of Post Concussive Symptom Scale (PCSS). Physical therapy evaluation and initiation of intervention was completed via Skype after Vestibular Ocular Motor Screening Tool (VOMs) completed by AT identified deficits requiring rehabilitation. Patient was instructed in a progressive aerobic exercise program, oculomotor, vestibular and cervical proprioceptive exercises as part of home program. Re-assessments occurred every 2 weeks via Skype with completion of VOMs by the on-site AT to track recovery. Progression into sport specific drills incorporating oculomotor, vestibular, balance, and proprioceptive exercises were implemented at 2 weeks and progressed as tolerated based on patients scores on VOMs.

Outcomes: Tele-examination revealed limited cervical range of motion (ROM), Cervical Joint Position Error Test outcome greater than 4.6 degrees in bilateral rotation and extension, abnormal oculomotor range of motion, smooth pursuits, hypometric saccades, convergence insufficiency, and positive uncover and alternate cover test outcomes. Following 6 weeks of tele-rehabilitation VOMs scores decreased from 57 to 10 and patient returned to prior level of all activities without symptomology.

Discussion: Physical therapy intervention delivered via tele-rehabilitation appears to be an effective way to manage patients with PCS and may serve as a viable method of delivery for patients that do not have immediate access to a physical therapist to include rural regions of the United States. This method of delivery of care involved inter-professional collaboration with athletic training and may have significant implication in the future.

Title: The use of forced rate and one-legged cycling to improve walking capacity in a patient with Parkinson's Disease and Chronic Obstructive Pulmonary Disorder

Authors/Institutions: B. Toprani, Physical Therapy Program, A.T. Still University, Mesa, Arizona, UNITED STATES | M. Eikenberry, Physical Medicine and Rehabilitation, Mayo Clinic, Phoenix, Arizona, UNITED STATES

Abstract Body:

Background & Purpose: Emerging evidence suggests that chronic obstructive pulmonary disease (COPD) may increase the risk for developing Parkinson's Disease (PD), although the cause of this relationship remains unknown. Both conditions are chronic and progressive, and lead to decreased function and reduced quality of life with increased morbidity and mortality. Physical therapy (PT) is routinely prescribed for the management of each condition, however there is very limited evidence guiding the therapeutic management of patients with both conditions. Forced rate cycling exercise (FE) is a recognized treatment strategy for use in improving bradykinesia in patients with PD. Additionally, there is evidence supporting the use of one-legged cycling to improve endurance in patients with COPD. This case study will demonstrate the combined use of FE with one-legged cycling to improve functional mobility and endurance in a patient with PD and COPD.

Case Description: An 84 year old male with a history of PD and COPD was admitted to an inpatient rehabilitation facility (IRF) following a functional decline secondary to a recent small bowel obstruction. At IRF admission, he presented with decreased endurance, absent backwards protective stepping responses and required minimal assistance for transfers and ambulation with a rolling walker. The patient completed 12 PT sessions, with six 30 minute sessions dedicated to FE and one-legged cycling. The cycling sessions were interval based sessions in which the patient completed intervals of bilateral and one-legged forced rate cycling. Six additional 60 minute circuit training sessions to address additional impairments were completed.

Outcomes: Pre and post measures included the Mini BESTest, 6 minute walk test (6MWT), 10 Meter Walk Test (10MWT) and the Timed Up and Go (TUG). Mini BESTest score improved from 15/28 to 17/28 (MCID of 5.52 in PD). The 6MWT distance improved from 214.9 meters to 327.1 meters (MCID 54 meters in COPD). The 10MWT improved from a gait speed of 0.81m/s to 0.99m/s (MCID 0.13 m/s). The TUG improved from 17.6 seconds to 12.0 seconds (MDC 4.85). The patient was able to ambulate community distances with use of a rolling walker modified independently at IRF discharge.

Discussion: These findings suggest that the combination of FE and one-legged cycling along with a circuit training approach to address impairments was an effective treatment strategy for this patient to improve waking capacity. Despite the short duration of this case study, the patient achieved clinically meaningful improvements in gait speed and walking capacity. Due to the progressive nature of PD and typical later onset in life, it is common for patients with PD to have multiple medical conditions. It is important for therapists to consider the PT management of medical comorbidities when designing a plan of care. Clinicians that are treating a patient with impairments from PD and COPD may consider the use of FE one-legged cycling as a potential treatment strategy.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: The Necessity for Post-Maneuver Restrictions in the Treatment of Benign Paroxysmal Positional Vertigo: An Updated Systematic Review and Meta-Analysis

AUTHORS/INSTITUTIONS: R. Clendaniel, Duke University, Durham, North Carolina, UNITED STATES| C.M. Cromwell, J. Tyler, R. Nobbs, A. Hockaday, S. Donnelly, Doctor of Physical Therapy, Duke University, Springdale, Arkansas, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Many studies have published conflicting results regarding the necessity of post-maneuver postural restrictions following CRM treatment of BPPV. The purpose of this meta-analysis is to complete an updated, comprehensive review to determine best practice following a CRM.

Number of Subjects: 739 subjects from 11 studies

Materials/Methods: PubMed, CINAHL and Embase were all searched from the time of their establishment through July 2016. Searching of the reference lists of the selected studies was performed for possible studies that were not identified in the electronic database searches. Studies investigating the effect of post-maneuver postural restrictions on CRM treatment of BPPV were included, published from 1996 to 2015. The methodology, number of participants, type of canalith repositioning maneuver administered, post-maneuver restrictions implemented, outcome measures, and results for each included study were recorded. Following data extraction, heterogeneity and homogeneity values of included studies were determined. Risk ratios and random effects values were also obtained in order to determine the effect size.

Results: The results of the eleven included studies in the meta-analysis can be found in Figure 2. The results of 739 total subjects were analyzed, 362 of which received post-maneuver postural restrictions and 377 of which did not. This meta-analysis revealed that there was not a statistically significant difference in treatment success rates between patients who received post-CRM postural restrictions and those that did not (p=0.095).

Conclusions: There was no significant difference found in treatment efficacy between subjects who received post-maneuver postural restrictions and those who did not. Based on these results, prescribing such restrictions is not necessary, and due to patient inconvenience is therefore not aligned with best practice.

Clinical Relevance: The results of the current meta-analysis indicate that the use of post-maneuver postural restrictions does not improve the efficacy of the repositioning maneuvers for treatment of BPPV. Therefore, both treatment efficacy and patient comfort can be preserved by abstaining from the use of post-treatment postural restrictions.
**TITLE:** Lower limb kinematics following gait rehabilitation: knee hyperextension associated with gains in hip extension in adults post-stroke

**AUTHORS/INSTITUTIONS:** C. Conroy, Motion Analysis Center, Brooks Rehabilitation, Jacksonville, Florida, UNITED STATES| A. Vistamehr, Motion Analysis Center, Brooks Rehabilitation Hospital, Jacksonville, Florida, UNITED STATES| D.K. Rose, Brain Rehabilitation Research Center, North Florida/South Georgia VHS, Gainesville, Florida, UNITED STATES| E.J. Fox, Physical Therapy, University of Florida, Gainesville, Florida, UNITED STATES| L. DeMark, Research, Brooks Rehabilitation, Jacksonville, Florida, UNITED STATES

**ABSTRACT BODY:**

**Purpose/Hypothesis:** Individuals post-stroke demonstrate reduced walking speeds and impaired kinematics such as reduced hip extension and knee hyperextension. Although gait rehabilitation induces gains in speed and improved hip extension during walking, the effect on knee hyperextension is poorly understood. Knee hyperextension is an important concern as it can lead to joint instability and degenerative joint disease. Although it is known that ankle impairments contribute to knee hyperextension during walking, there is little understanding of the relationship between changes in hip extension and the development or worsening of knee hyperextension. The purpose of this preliminary study is to test the hypothesis that increased hip extension following gait rehabilitation is associated with increased knee hyperextension in adults post-stroke.

**Number of Subjects:** 10

**Materials/Methods:** Ten adults post-stroke (60 ± 5.4 years; 6 male; 6 left hemiparesis; 12.9 ± 4.8 months post-stroke) participated in three-dimensional gait analysis prior to and following 18 sessions of gait rehabilitation (90 min, 3 times/week for 6 weeks). Lower limb kinematics were recorded during 3 walking trials over-ground at a self-selected pace. Pre and post intervention walking speeds as well as peak paretic hip extension angles were compared using a paired t-test. Pearson correlations (n=10) were used to assess the association between changes in peak paretic knee extension angles and hip extension angles, as well as with changes in walking speed.

**Results:** Following gait rehabilitation, average self-selected speeds increased by 0.08 ± 0.11 m/s (p=.05), but did not exceed the level of minimal clinically important difference (i.e., 0.16 m/s). As a group, paretic hip extension increased (p=0.04). Further, changes in hip extension were positively correlated with knee extension (r=0.57, p=.078). Six of 10 participants demonstrated increased paretic hip extension (11.7 ± 7.9°), and 5 of these 6 developed or demonstrated increased knee hyperextension (i.e. > 0°; 7.3 ± 4.8°). Knee changes were not associated with walking speed changes (r=-0.15, p=0.67).

**Conclusions:** Following gait rehabilitation, more than half of the participants demonstrated greater paretic hip extension. However, the majority of these individuals also demonstrated worsening knee kinematics evident by greater knee hyperextension. Interestingly, the small gains in walking speed post intervention were not associated with these maladaptive knee changes.

**Clinical Relevance:** Gait rehabilitation may lead to improvements in walking kinematics, but also may contribute to maladaptive changes such as knee hyperextension. Kinematics are influenced by numerous factors. For instance, prior studies have shown that knee hyperextension is associated with ankle impairments. Clinicians should consider these complex factors to ensure the benefits of gait rehabilitation are not at the expense of concurrent negative changes.
Purpose/Hypothesis: Massed practice is an established method for increasing motor ability of the more affected upper extremity. However, the extent of motor recovery varies widely amongst individuals and it remains unclear which elements of motor practice are most appropriate for which individuals. The purpose of this study was to determine which sensorimotor characteristics were the most predictive of motor recovery following two very different modalities of motor restorative practice. Specifically, we hypothesized that impaired somatosensation would be particularly disruptive to motor recovery amongst individuals with poorer baseline motor ability. We also hypothesized that those with poorer baseline function on the domain most heavily trained by the therapy modality would benefit more from the intervention.

Number of Subjects: Number of Subjects: 54

Materials/Methods: A total of 54 participants with chronic stroke underwent one of two CI therapy modalities. 35 participants received standard Constraint Induced Movement (CI) therapy that emphasized fine motor practice involving object manipulation in the clinic. The remaining 19 participants received gaming CI therapy administered using a Microsoft Kinect system in the home. The gaming therapy more heavily emphasized gross motor performance involving virtual objects. Motor and somatosensory ability were assessed using the Wolf Motor Function Test (WMFT), the Brief Kinesthesia Test (BKT) and Touch Test Monofilaments. The pretreatment scores on these assessments served as inputs to an Enhanced Probabilistic Neural Network (EPNN) to categorize extent of motor recovery as low, moderate, or high (based on change in WMFT performance time).

Results: In the standard and gaming CI therapy data sets, we were able to correctly categorize the improvement of 100% and 94.7% of individuals, respectively, based on their baseline characteristics. Contrary to hypothesis 1, we found that baseline gross motor ability was the most robust predictor of the extent of recovery irrespective of therapy modality, whereas somatosensation was much less influential. Consistent with hypothesis 2, we found that those with poorer baseline ability on the domain that is most heavily trained by the therapy modality demonstrated the most improved motor ability.

Conclusions: For individuals with chronic mild-to-moderate upper extremity hemiparesis, the extent of motor recovery after therapy can be predicted with high accuracy given only knowledge of baseline motor ability, particularly gross motor ability.

Clinical Relevance: Motor restorative therapies may be most beneficial for individuals with residual gross motor impairment, whereas individuals with near-normal gross-motor ability may benefit more from interventions that focus on overcoming learned non-use. Advanced computational approaches allow for accurate personalized therapy-planning that could greatly increase the efficiency and cost-effectiveness of care.
Purpose/Hypothesis: Stroke represents one of the leading causes of long-term disability worldwide. While exercise interventions have utility in facilitating the functional recovery of those with chronic stroke, routinely, these interventions are gait-specific. Non-bodyweight-supported treadmill training (TT) has been useful in the recovery of gait performance, specifically gait speed and endurance, but its efficacy on balance dysfunction has not been systematically reviewed.

The notion that highly-specific TT imparts a positive impact on balance is in contrast to the training principle of specificity. Skill transference, or reverse transfer, as defined by Hornby et al. (2011), is the idea that repetitive practice of walking tasks may improve non-walking functional tasks. The purpose of this systematic review was to determine the effect of TT interventions on static and dynamic standing balance in individuals with chronic stroke.

Number of Subjects: Eight randomized controlled trials (RCT) met eligibility criteria. Mean age of participants was 54.8 years, with mean durations of stroke onset ranging from 6.3 to 70 months.

Materials/Methods: A systematic literature search of PubMed, EMBASE and CINAHL was performed. Eligible RCTs were published between 2007 and 2016, investigated TT interventions in persons with chronic stroke, and included at least one objective balance measure. Study quality was assessed using PEDro criteria.

Results: Studies differed in TT implementation and use of the following adjuncts: FES, visual deprivation, rotational TT, dual-tasking or Nordic walking. Six studies used the Berg Balance Scale, while two studies used limits of stability testing to quantify balance. Seven studies met PEDro condition for higher quality, and all studies demonstrated improvements in balance measures that were at least as effective as conventional physical therapy treatment, including targeted balance training.

Conclusions: This review recognized moderate evidence in favor of TT in balance and stroke rehabilitation programs. With this practice, intensity may be a more critical factor than specificity and may offer additional carryover to recovery parameters of postural control beyond gait performance. By altering cognitive demand, muscle unit recruitment or sensory involvement, intensity may be modified to garner reverse transfer effects in objective balance measures. Additional research is needed to denote the critical parameters by which improvements in balance may be optimized.

Clinical Relevance: In contrast to commonly-used interventions for balance recovery and postural stability, TT may be performed at intensities and dosages greater than those of traditional balance training. Improvements in objective balance measures, in addition to the well-recognized gains in cardiovascular and locomotor function, exist as “off-label” benefits confirming skill transference to non-walking functional balance measures. Clinicians utilizing TT should incorporate objective balance measures to assess the potential for skill transference and functional improvements in balance.
Title: Therapeutic Management of a Patient with Multiple Sclerosis and a Functional Movement Disorder

Authors/Institutions: M. Eikenberry, Physical Medicine and Rehabilitation, Mayo Clinic, Phoenix, Arizona, United States | V. Schwartz, Physical Therapy Program, Bellarmine University, Louisville, Kentucky, United States

Abstract Body:
Background & Purpose: Multiple Sclerosis (MS) is an autoimmune disease characterized by central nervous system demyelination and formation of plaques, leading to impaired nerve impulse transmission. Functional Movement Disorder (FMD) is an involuntary learned movement pattern that is habituated by abnormal attention, commonly triggered by physical or psychophysiological events and mediated by the individual's illness beliefs and expectations. FMD is associated with high levels of disability and distress, poor prognosis, and high financial burden. With both MS and FMD, patients may present with impaired gait and walking ability. This case study will highlight the clinical decision making and application of best available evidence to the physical therapy (PT) management of a patient with both MS and FMD.

Case Description: A previously independent 25-year-old female with recently diagnosed MS presented to an inpatient rehabilitation facility (IRF) with incomplete paraplegia and inability to walk. Medical work up prior to IRF admission determined the cause of paraplegia to be due to FMD and not an MS exacerbation. Positive examination findings suggestive of FMD included a positive Hoover's sign, hip abductor sign and gait deviations with a non-neurological presentation. The PT treatment goal was to blend the best available evidence for gait training in patients with MS with the consensus approach for patients with FMD. Treatment consisted of a progression from body weight supported treadmill training (BWSTT) to over ground gait training, functional strengthening, balance training and patient education. All interventions were designed with utilization of the consensus recommended principles for PT management of FMD. Interventions were carried out for 10 consecutive days for 90-120 minutes per day.

Outcomes: The Six Minute Walk Test (6MWT), Functional Gait Assessment (FGA), Berg Balance Scale (BBS) and Modified Fatigue Impact Scale (MFIS) were assessed at admission and discharge. Changes in gait were measured via clinically observed gait analysis. 6MWT improved from 0 to 510 meters. Berg improved from 5 to 56. FGA improved from 0 to 30. All functional outcome measures reflected clinically meaningful improvements (greater than established MDC or MCID in MS population) at rehab discharge. Patient reported measure of fatigue improved at discharge but not greater than the established MCID in patients with MS. The patient was independent with all functional mobility at the community level and demonstrated a normalized gait pattern at discharge.

Discussion: These findings suggest a benefit for using a blended treatment approach to improve walking capacity and balance for this patient with MS and FMD. It is important for clinicians to recognize the examination features of FMD and the suggested treatment approach in order to develop an effective individualized plan of care. Clinicians treating patients with MS and FMD may find these treatment approaches helpful to improve clinical efficiency, optimize functional outcomes and improve perceived disability.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC.


responsiveness and concurrent validity of three Dutch self-report questionnaires." Disabil Rehabil 32(22): 1870-1876

Background & Purpose: Ramsay Hunt syndrome (RHS), also known as cranial polyneuropathy, is a rare complication of the varicella zoster virus (VZV). Facial and vestibulocochlear nerves are the most commonly affected, with other cranial nerves rarely involved. It typically presents with a vesicular rash on the ear or in the mouth, and facial paralysis. Other symptoms include ear and face pain, hearing loss, vertigo, and imbalance. The prognosis is poor as compared to Bell’s Palsy. The recovery rate is as low as 10-30% of patients who fully recover when left untreated. RHS develops in 0.2% of those primary VZV infections and is even rarer to occur bilaterally. Early detection and treatment including antiviral medications and steroids is vital. Research describing physical therapy (PT) interventions to treat patients diagnosed with RHS is limited. This case report presents a patient with bilateral RHS and persistent imbalance and dizziness treated with outpatient vestibular physical therapy (VPT).

Case Description: A 75 year old female presents to VPT with chief complaints of imbalance and dizziness worsening over the past few months. She was given a diagnosis of RHS in 2005 during initial onset of imbalance and dizziness. She presents with a positive bilateral head thrust indicating a possible bilateral vestibular dysfunction. She presents with a R-beating nystagmus following horizontal head shaking that may indicate an asymmetrical vestibular impairment. She presents with a gait speed of 0.91m/s and score of 9 on the Dynamic Gait Index (DGI) indicating a poor dynamic standing balance and increased risk for falls. She scored 36 on the Dizziness Handicap Inventory (DHI) indicating a moderate handicap and scored 49% on the Activities Specific Balance Scale (ABC) indicating a low level of functioning and a prediction of future falls.

Treatment included gradual progressions of ambulation with head turns, dynamic and static standing balance training with eyes closed, ambulation over dynamic surfaces and horizontal/vertical vestibular ocular reflex training. Treatment included eighteen 45 minute sessions.

Outcomes: At discharge, she demonstrates significantly improved dynamic standing balance and reduced fall risk as noted with score of 21 on the DGI and increased gait speed of 1.2m/s. She reports overall improved confidence with all functional mobility as noted with score of 93% on the ABC. In addition, she reports resolved dizziness with score of 0 on the DHI. Lastly, she has returned to the gym and lap swim in order to transition from PT to independent exercise.

Discussion: Current evidence of PT management in individuals with RHS is limited. This case report demonstrates the effectiveness of VPT for one individual with RHS. Although this patient presented with bilateral vestibular involvement she demonstrated improvement. VPT intervention may improve dizziness symptoms and dynamic balance in individuals with RHS and is an area to be further explored.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Purpose/Hypothesis: The most common cognitive disability that follows a stroke is unilateral spatial neglect (USN), found in approximately 50% patients. The use of virtual reality (VR) systems for the assessment and rehabilitation of USN could be more interesting and consequently more effective than the conventional methods used for USN rehabilitation. This study investigated the effects of a VR rehabilitation system with gesture recognition (GR) on unilateral spatial neglect, visual perception, and activities of daily living in subacute stroke patients.

Materials/Methods: The subjects of this study were 16 individuals who had had strokes and who had been admitted to a rehabilitation center in the Republic of Korea. The patients were divided into a VR with GR group (n=8) and a conventional training group (control group, n=8). The intervention was conducted for 30 minutes, three times a week for 4 weeks for both groups. The outcome measures were assessed using the line bisection test (LBT), the Catherine Bergego Scale (CBS), and the modified Barthel index (MBI). Measurements were completed pre- and post-intervention.

Results: The results of this study showed that the VR rehabilitation system with GR led to greater recovery of self-awareness of behavioral neglect than did conventional training in stroke patients with USN. This result indicates that VR with GR could help stroke survivors to look towards the contra-lesional side. Both groups of patients showed improvements in their LBT, CBS, and MBI; however, inter-group differences were noted in the LBT and CBS.

Conclusions: The results indicate that a VR rehabilitation system with GR improves patients’ self-awareness of behavioral neglect; it can be used for the clinical rehabilitation of subacute stroke patients with decreased attention on the contra-lesional side of space and a damaged right hemisphere-dominant attention-shift mechanism.

Clinical Relevance: With the development of VR technology, researchers can take advantage of the potential of VR for the rehabilitation of USN. The necessary collaboration between clinicians and technicians to set up VR rehabilitation systems with GR, and the costs related to the design, maintenance and use of a VR rehabilitation system with GR, should be further considered. In addition, the VR with GR can also improve traditional assessment methods by providing information about head movements, postural deviations, and limb kinematics, which can be useful in detecting subtle deficits.
In Patients Post Stroke, Does Body Weight Supported Treadmill Training Result In Increased Walking Ability Compared to Overground Walking Training? A Systematic Review.

K. Jones, E. Shane, B. Behrens, B. Ernst, B. McNeal, Physical Therapy, Southwest Baptist University, Bolivar, Missouri, UNITED STATES

Purpose/Hypothesis: Every 40 seconds someone in the United States has a stroke. Stroke is the third leading cause of death and the number one cause of long-term disability in the US. After a stroke, patients can present with certain changes in their gait patterns such as slower gait speed, stride length difference, and a shorter stance phase on the affected leg. The purpose of this systematic review is to investigate if body weight supported treadmill training (BWSTT) results in an increased walking ability when compared to overground training. This is relevant to the field of physical therapy as it is a common disorder that impacts quality of life and functional independence.

Number of Subjects: NA

Materials/Methods: Cochrane Central register of controlled trials, CINAHL complete, and MEDLINE were searched using the keywords: (body weight supported treadmill training) AND (stroke) AND (gait training* or over ground gait training*) with a date published limitation of April 2014 through April 2017. The study design is a systematic review evaluating articles that met all inclusion criteria.

Results: Five studies were included with a total of 199 participants. These randomized control trials concluded that gait speed improved in patients who received BWSTT versus those who received overground training only. Gait recovery, lower limb motor patterns, and balance showed greater improvement after BWSTT when compared to overground training. It was also concluded that combining forward and backward BWSTT showed more significant improvements than just forward BWSTT or backward BWSTT walking alone.

Conclusions: When reviewing these studies, no significant difference was noted when comparing BWSTT to overground training. While there are improvements seen in other areas of gait and patient outcomes, none were statistically significant. Further research is needed in this area and should be more narrowed to identify if there are any advantages for BWSTT in patients with a stroke.

Clinical Relevance: Patients who receive BWSTT can be expected to improve in gait speed. Other improvements have been seen with BWSTT but they are not significantly different than other types of gait training. In the clinic, physical therapists will need to focus on all factors surrounding their patient and determine if BWSTT will be a relevant and effective tool for rehabilitation of gait. Factors to consider when deciding what form of gait training to apply are patient preference, clinical setting, available time, or if gait speed is the primary goal. It has also been studied that combining both forward and backward walking will aid in increased overall gait results. The bottom line is that BWSTT will improve gait in all areas, with gait speed being the most significant.
Background & Purpose: High intensity, variable stepping training has demonstrated improvements in balance and gait in persons with stroke. There is minimal research on this intervention in persons with chronic traumatic brain injury (TBI). The purpose of this study is to describe the effects of high intensity, variable stepping training on balance in a person with chronic TBI.

Case Description: The patient was a twenty-nine year old male, seven years after a severe TBI. The patient’s initial TBI recovery was complicated by meningitis and a pontine cerebral vascular accident. For this case report, the patient participated in ten one-hour physical therapy sessions over six weeks as a participant in a university physical therapy course. At initial evaluation he had right hemiparesis and walked without an assistive device, however required supervision due to impulsiveness, decreased safety awareness and impaired balance. His most recent fall was four months prior. His mother also reported he was unable to get up from the floor independently. Intervention focused on high intensity, variable stepping training which included: multi-directional walking, dual-task training and obstacle negotiation on a treadmill with safety harness support, overground walking obstacle course, stair climbing, virtual reality stepping game, and soccer drills. He also practiced floor to stand transfers.

Outcomes: After 8 intervention sessions the patient demonstrated meaningful improvements in the following outcomes (pre-, post-intervention): mini-BESTest (14/28, 20/28 points), Timed Supine to Stand Test (unable, 11.6 s with supervision). Outcomes which did not demonstrate meaningful improvement were (pre, post-intervention): 6 minute walk distance (379, 359 m) and four square step test (13.6, 13.1 s).

Discussion: The patient demonstrated improved reactive postural control on the mini-BESTest and the 6 point total score increase at post-intervention exceeded the established minimal detectable change of 3.5 points. The ability to complete a floor to stand transfer with supervision increased his functional mobility and ability to participate in activities on the floor. High-intensity, variable stepping training and floor to stand transfer training should be considered as interventions to improve balance and functional mobility in persons with chronic TBI.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: The Effects of Yoga Breathing and Postures on Non-Motor Symptoms and Balance in Individuals with Parkinson's Disease: A Pilot Study

AUTHORS/INSTITUTIONS: P.K. Ghosh, A. Booher, M. Kralemann, E. Siesener, B.N. Amling, Physical Therapy, Maryville University, St. Louis, Missouri, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Individuals with Parkinson's disease (PD) frequently present with various non-motor symptoms (NMS), including depression, stress, and sleep disturbances, in addition to impaired motor functions. 1 Yoga breathing and postures have been shown to reduce sympathetic activity leading to improvements in sleep, mood, and stress. 2,3 Practice of yoga can also improve motor symptoms in individuals with PD. 4 Recently, a review by Roland indicated practicing yoga can influence NMS of other neurological diseases. 5 There has been no research performed studying the effects of yoga on NMS and balance in individuals with PD. Therefore, the purpose of this study was to determine the effects of practicing yoga breathing and postures on NMS and balance in individuals with PD.

Number of Subjects: Eight participants (4 males and 4 females; mean age of 73 ± 7 years) with PD in stages I-III on the Hoehn and Yahr scale, who could walk 50 ft. independently, were recruited.

Materials/Methods: Each participant took part in a 11-week yoga program, consisting of a 60-minute weekly group session and 60 minutes of practice at home (4 days/wk). Each session consisted of 7 breathing and 4 posture exercises. Outcome measures used include the Perceived Stress Scale (PSS-14), the Parkinson's Disease Sleep Scale (PDSS), the Parkinson's Disease Questionnaire-39 (PDQ-39), the Hospital Anxiety and Depression Scale (HADS) and the Mini Balance Evaluation Systems Test (Mini-BESTest). Data was collected by blinded assessors at the initial visit (wk 1), at 6 wk, and at 11 wk. A Friedman test was performed to determine statistical significance (p<0.05). A post-hoc analysis was performed using a Wilcoxon signed-rank test with a Bonferroni correction (p<0.017).

Results: Median scores and ranges for the PSS-14, PDSS, PDQ-39, HADS, and Mini-BESTest were calculated at 1, 6 and 11wk. The Friedman's ANOVA showed statistical significance for all 5 outcome measures. The post-hoc analysis showed significant reductions in median PSS-14 scores from 16 to 11 after 6 wk. (p=0.011) and to 7.5 after 11 wk. (p=0.011). Median PDSS scores showed significant increase from 112.5 to 124.5 after 6 wk. (p=0.011) and to 130.5 after 11 wk. (p=0.012). Median PDQ-39 scores showed significant decrease from 22.5 to 11 after 6 wk. (p=0.012) and to 7.5 after 11 wk. (p=0.012). Mini-BESTest scores also showed significant increase from 20 to 24.5 after 6 wk. (p=0.011) and to 26 after 11 wk. (p=0.012). Median HADS scores showed a reduction from 15.5 to 7.0 after 6 wk. (p=0.018) and to 3 after 11 wk. (p=0.028).

Conclusions: Our study suggests that practicing yoga breathing and postures for 11 weeks decreased NMS and improved balance in individuals with PD. However, further research with a larger sample size and a control group is required to generalize the effects of yoga breathing and postures on the NMS and balance.

Clinical Relevance: Practice of yoga breathing and postures could be advantageous for improvement of NMS and balance in individual with PD and may be used as adjunct during their rehabilitation.
TITLE: Being Part of the Community: Perceptions of Public Transit by People with Disabilities

AUTHORS/INSTITUTIONS: J. Drews, L. Fons, E. Scharf, K. Thompson, B. Weber, K. Zalewski, University of Wisconsin-Milwaukee, Shorewood, Wisconsin, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis : The purpose of this qualitative study is to describe the experience of using public transportation (fixed route, taxi, and paratransit) by people with disabilities. We hypothesize that people with disabilities will state a preference to using paratransit services to support transportation needs.

Number of Subjects : The focus group consisted of five individuals (four females and one male, all over 50 years old) with physical and sensory disabilities living in Milwaukee County.

Materials/Methods : Focus group participants were recruited through the Milwaukee County Transit Service (MCTS). Nine people were screened and six met the eligibility requirements for participation. Five subjects participated in a semi-structured focus group discussion directed at capturing the experience of using public transportation. A graphic artist was present to visually depict the discussion, allowing participants to give immediate feedback on themes emerging from the conversation. The focus group conversation was recorded and transcribed, and a phenomenological approach was used to identify common themes and sub-themes in the dialogue. These themes were summarized in a concept map provided to participants for affirmation.

Results : The central organizing theme was the desire on behalf of participants for personal involvement in their community. Public transportation is critical for facilitating this involvement. Sub-themes emerging from involvement included community culture emphasizing understanding of people with disabilities, community infrastructure, personal gumption, and available transportation options. Participants expressed the desire that communities would structure transportation options based on the transportation need rather than on the abilities of the traveller.

Conclusions : The three community derived factors (community culture, infrastructure, and available transportation options) currently create a sense of people with disabilities being “separate but equal” when exploring the role of transportation to facilitate involvement in one’s community. The observed theme of gumption, defined as spirited resourcefulness and advocacy is identified as a personal characteristic of those successfully engaging by using multiple transportation options.

Clinical Relevance : Efforts aimed at improving public transportation for individuals with disabilities should be directed toward exploring external factors of community culture, infrastructure, and choice of transportation for people with disabilities living in one’s community. It is possible these factors may have the greatest influence on determining the extent to which individuals with disabilities are able to be fully involved in society.

AUTHORS/INSTITUTIONS: L.M. Pacho, D. Basso, School of Health and Rehabilitation Sciences, The Ohio State University, Columbus, Ohio, UNITED STATES|A.R. Filous, J. Schwab, Department of Neuroscience, The Ohio State University College of Medicine, Columbus, Ohio, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis: Reversible functional decline in response to hyperthermia in demyelinating disease was first described by Dr. Uhthoff in 1890 for diagnosing Optical Neuritis as a symptom of Multiple Sclerosis. Spinal cord injury (SCI) also involves demyelinating processes that contribute to decreased neuromotor function. While SCI demyelination and remyelination research exists, we currently have no way of studying how these processes affect function, which is critically important to patients with SCI. Exposing animals to mild hyperthermia may lead to nerve conduction delay or block in thinly myelinated or non-myelinated axons resulting in reversible functional deficits. The purpose of this study was to delineate the functional effects of demyelination after SCI and develop a standardized functional assessment of outcomes for SCI research.

Number of Subjects: 21 female, adult C57BL/6J mice with contusion SCI.

Materials/Methods: Graded contusions, mild to severe (60 to 90 kdyn), occurred under anesthesia 4-6 wks prior to swim testing. Two 20-gallon swim tanks containing room temperature (RT; 28-30°C) or warm water (40-42°C) were used for 4 alternating, 1 min swim bouts. A randomized start into RT (n=14) or warm water (n=7) occurred. Video-based behavioral analysis compared functional decline with warm water swimming and recovery in RT water. Latency and magnitude of worst and best swim performance quantified motor function.

Results: Graded SCI resulted in reversible swimming functional decline for all injuries. Worst performance occurred in the warm water condition with cessation of hindlimb swim strokes. This disuse was reversible and stroking returned on average in 36.5 (SEM 2.39) seconds in RT water. Latency to return of function was positively correlated with injury severity (R = 0.91, p <.05) and occurred in a graded manner. Additionally, characteristic behavioral change between warm and RT swimming occurred across all animals and was developed into a 6-phase assessment. Kinematic analysis of trunk and limb deficits are underway.

Conclusions: We show that reversible neuroworsening occurs in a graded manner aligned with SCI severity. Intra-individual fluctuations of neuronal circuitry function are drastic, highly dynamic, and reproducible. They may serve as a template to better understand a disconnect between morphology and function after SCI. The rapid reversibility suggests that poor myelination and heat-induced conduction failure may play a role.

Clinical Relevance: Following SCI, demyelination plays a key role in loss of motor function. Understanding the role of demyelination in neuromotor function after SCI may be aided by using a mild hyperthermic challenge. This approach can be used either as a measure of myelin plasticity during rehabilitation or perhaps as a treatment challenge to increase recovery. Additionally, it may aid in our understanding of how infection, therapeutics, or rehabilitation positively or negatively affect myelin and function in SCI patients.
TITLE: Within Session and Between Session Reliability of Cortical Hotspots Using Motor Evoked Potentials and Normalized Latencies

AUTHORS/INSTITUTIONS: E.C. Wonsetler, Department of Health Sciences and Research, Medical University of South Carolina, Charleston, South Carolina, UNITED STATES|A.M. Lynch, S.L. Czaus, M.G. Bowden, Division of Physical Therapy, Medical University of South Carolina, Charleston, South Carolina, UNITED STATES|

ABSTRACT BODY:

**Purpose/Hypothesis:** Cortical mapping is suggested to identify the appropriate stimulation spot in the motor cortex for TMS investigations. This “hotspot” is traditionally defined as the spot over the motor cortex that elicits the largest EMG response, quantified by the amplitude of the motor evoked potential (MEP). Previous work in our lab has demonstrated that MEP amplitude is not a consistent measure in assessing tibialis anterior (TA) or soleus (SOL) neuro-motor excitability, and work in the upper extremity suggests that latency measures are feasible to quantify cortical representations and locate optimal stimulation sites. The purposes of this experiment were to: 1) quantify the reliability of MEP amplitude and normalized latency (N-LAT, latency divided by participant’s height) for the hemiparetic TA and SOL; and 2) compare the locations of the stimulus hotspots for MEP amplitude and N-LAT, both within and between sessions.

**Number of Subjects:** 20 individuals with chronic hemiparesis (mean age 60.4±12.0 yrs, 10 male, 16 with right hemiparesis, 36.8±31.5 months post-stroke) were enrolled. 14 participants completed the study. 5 individuals lacked measurable MEP amplitudes and 1 was lost due to drop-out.

**Materials/Methods:** Each participant’s MRI was uploaded into a neuronavigation system (Brainsight), and a 3x5 grid, with targets 10 mm apart, was centered over the lesioned hemisphere’s motor cortex. EMG electrodes were placed on the paretic TA and SOL. The grid was systematically assessed twice on each testing day. For each stimulus, we recorded MEP amplitude and calculated N-LAT. We used the ICC (3,1) to assess within and between session reliability.

**Results:** Within session: The MEP amplitude reliability for the TA is 0.798 and for the SOL is 0.487. The N-LAT reliability for the TA is 0.916 and for the SOL is 0.892. MEP and N-LAT TA hotspot location was the same in 20% of trials, with an average distance of 18.7±8.0mm between differing hotspots. SOL hotspots were the same in 32% of trials, with an average distance of 18.7±7.6mm between differing hotspots.

Between session: The MEP amplitude reliability for the TA is 0.782 and for the SOL is 0.396. The N-LAT reliability for the TA is 0.912 and for the SOL is 0.814. MEP and N-LAT TA hotspot location was the same in 32% of trials, with an average distance of 17.9±9.7mm between differing hotspots. SOL hotspots were the same in 24% of trials, with an average distance of 20.7±10.6mm between differing hotspots.

**Conclusions:** This work demonstrates that N-LAT is a more reliable measure, both within and between sessions, for the TA and the SOL. As the majority of the hotspots identified using N-LAT differed from those identified using MEP amplitude, given the greater reliability of N-LAT, perhaps it is a better determinant of the cortical “hotspot.”

**Clinical Relevance:** Non-invasive brain stimulation to quantify motor control post-stroke continues to demonstrate great potential, but remains in the pre-clinical, exploration phase.
TITLE: FOR PERSONS WITH PARKINSON’S DISEASE, ARE CUEING INTERVENTIONS EFFECTIVE IN REDUCING FREEZING OF GAIT?

AUTHORS/INSTITUTIONS: G.G. Fluet, Rehabilitation and Movement Sciences, Rutgers The State University of New Jersey, Iselin, New Jersey, UNITED STATES|S. Isaacson, A.L. Cosentino, S. Poltricitsky, T. Byrne, T. May, J. Camelotto, M. Cordovi, D. Gilboa, Rutgers University, Aberdeen, New Jersey, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Freezing of gait (FOG) is a particular phenomenon affecting those with Parkinson’s disease (PD) that includes a temporary, involuntary inability to move. The presence of FOG correlates with decreased quality of life and decreased independence. Cueing interventions are frequently used in the treatment of PD, but evidence is needed to investigate the effect of cueing interventions on freezing of gait in persons with PD. The purpose of this research was to evaluate the evidence supporting the use of cueing interventions to reduce FOG for persons with PD.

Number of Subjects: The participants in the 5 studies had a H&Y score of 2.75-3.2 with a PD duration of 7.5-13.05 years. Participants ranged in ages from 66-72 years old.

Materials/Methods: PubMed and Medline were searched using keywords: parkinson*, freez*, fall, outcome, rehab*, intervention, gait disorders, physical therapy. 105 hits resulted from the search in Pubmed and 30 hits resulted from the search in Medline. Inclusion criteria: PD diagnosis, outcome measure relating to FOG, feasible in clinic, and cueing intervention(s). Exclusion criteria: single session interventions and studies including participants with other conditions that could cause FOG.

Results: Five articles of 1b or 2b level of evidence met the inclusion and exclusion criteria. The participants in the 5 studies had H&Y score of 2.75-3.2 with PD duration of 7.5-13.05 years, and were 66-72 years old. Interventions lasted 2 weeks to 6 months and included self-selected and PT administered auditory, visual, cognitive and tactile cueing. Cueing interventions showed a statistically significant improvement in the FOG questionnaire (FOG-Q) and lab based measures.

Conclusions: Many cueing interventions are studied, but auditory cueing is studied most extensively. Longer interventions do not seem to show a greater impact. High compliance in the longer duration studies suggests that long term cueing might be feasible. The two scales used to measure FOG are the FOG-Q and the new FOG questionnaire (NFOG-Q). The studies that used the NFOG-Q did not yield statistically significant results. Significant changes in studies using the FOG-Q may be due to changes in gait rather than changes in FOG due to inclusion of questions not specific to FOG. The NFOG-Q may result in less significant results due to possible increased specificity. However, all studies reported improvement in FOG, indicating cueing interventions may slow the progression of FOG.

Clinical Relevance: Cueing interventions are feasible to perform in the clinic and in the home, which may have a positive impact on FOG in patients with PD.
TITLE: Validity of the NeuroCom VSR™ Balance System

AUTHORS/INSTITUTIONS: B.S. Robinson, M.K. Himes, J.L. Shaw, T.J. Jung, Physical Therapy, Missouri State University, Springfield, Missouri, UNITED STATES| K.J. Brad, Physical Therapy, Benefis Health System, Great Falls, Montana, UNITED STATES

ABSTRACT BODY:
Purpose/Hypothesis: The purpose of this study was to determine if the modified Computerized Test of Sensory Interaction in Balance (mCTSIB) as measured on the NeuroCom VSR™ Balance System (VSR™) is a valid measure of postural sway and fall risk when compared to the Sensory Organization Test (SOT) as measured on the NeuroCom EquiTest Balance System (EquiTest). We investigated three hypothesis: 1) mCTSIB Composite Score (CS) and SOT CS will be significantly correlated, 2) mCTSIB and SOT individual test conditions will be significantly correlated, and 3) mCTSIB CS will be significantly correlated with the Functional Gait Assessment (FGA) and the Activities-specific Balance Confidence Scale (ABC).

Number of Subjects: 23

Materials/Methods: Twenty-three community-dwelling older adults age 50 years or older (mean age = 63.8 ± 7.4, Male = 7, Female = 16) were recruited during Fall Prevention Awareness Day at a local senior citizen center. Participants had no history of neurological disorders, and if they had chronic medical conditions, they were well controlled. Additionally, participants were able to stand independently for 20 minutes with or without an assistive device and had no history of orthopedic injury, surgery, or fracture in the past six months.

All participants completed the SOT, mCTSIB, FGA and the ABC. The SOT measures postural sway under six tests conditions with each condition repeated three times for 20 seconds. Conditions 1, 2, 4, and 5 of the SOT are similar to the four conditions of the mCTSIB: firm eyes open (FirmEO), firm eyes closed (FirmEC), foam eyes open (FoamEO), and foam eyes closed (FoamEC) with each condition repeated three times for 10 seconds.

Results: The SOT CS and the mCTSIB CS demonstrated a moderate to strong level of correlation (r = -.626). When specific conditions were compared between the SOT and the mCTSIB, the conditions of SOT1/FirmEO, SOT4/FoamEO, and SOT5/FoamEC all correlated with a level of significance at or below p = .01. When the specific conditions SOT2/FirmEC were compared, the correlation was not significant. Additionally, the SOT CS and the mCTSIB CS demonstrated a significant correlation with the FGA (r = .594 and r = -.803, respectively). The mCTSIB and the ABC were significantly correlated (r = -.676, p < .01).

Conclusions: Study results confirm hypotheses one and three, indicating the mCTSIB, as given on the VSR™, is a valid measure of postural sway and correlates with the SOT, the FGA and the ABC.

Clinical Relevance: The VSR™ is a portable system and is easily transported to different locations for balance and fall risk assessment. Results of this study indicate that the mCTSIB is a valid measure of postural sway and correlates with functional measures of balance and balance confidence.
TITLE: The Gaze Stabilization Test following Concussion


ABSTRACT BODY:
Purpose/Hypothesis: Concussion can cause dizziness, vestibular dysfunction, and oculomotor abnormalities. However, there are few functional measures of the vestibulo-ocular reflex (VOR) post-concussion. The Gaze Stabilization Test (GST) has been identified as a functional measure of the VOR. The purpose of this retrospective chart review is to examine the GST following concussion in those referred for vestibular physical therapy, and to determine the association between maximum achieved head velocity during GST and other measures of recovery following concussion, including computerized neurocognitive tests and patient-reported outcomes.

Number of Subjects: 158

Materials/Methods: Subjects included individuals aged 12 to 43 years with concussion who were assessed with the GST during their course of vestibular rehabilitation. Data and test results were obtained retrospectively from the electronic medical record and physical therapy chart. Correlations between GST velocity and the Immediate Post-Concussion Assessment Cognitive Test (ImPACT) results and between the GST and patient-reported outcomes [Activities-specific Balance Confidence Scale (ABC), Dizziness Handicap Inventory (DHI), and Post-Concussion Symptom Scale (PCSS)] were examined. Also, the effect of demographic variables and comorbidities on GST performance was evaluated.

Results: 105 out of 158 subjects (66.5%) had sport-related concussion. Horizontal and vertical GST results were positively correlated with the ABC and negatively correlated with the DHI. Horizontal GST was positively correlated with the visual motor processing speed domain within ImPACT. Males achieved significantly higher velocities than females in horizontal and vertical GST.

Conclusions: The GST was found to be correlated with visual motor processing speed, ABC and DHI in patients following concussion. Male patients performed better on GST than female patients.

Clinical Relevance: Impairments in visual motor processing speed and in GST may be an indication of vestibular involvement post-concussion. The GST assesses functional VOR required for optimal performance in sports and can aid in decision making for discharge from vestibular rehabilitation. Future work is needed to further evaluate the role of GST in concussion management.
TITLE: Use of Stroke EDGE Recommendations to Predict Fallers in an Acute Inpatient Rehabilitation Unit

AUTHORS/INSTITUTIONS: N. Zhang, Biostatistics, Mayo Clinic, Phoenix, Arizona, UNITED STATES| M. Eikenberry, C. Kinney, Physical Medicine and Rehabilitation, Mayo Clinic, Phoenix, Arizona, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Falls in the hospital setting are a common adverse event in patients with stroke. While most inpatient rehabilitation facilities (IRF) have protocols for fall prevention, the incidence of falls remains high. Several fall risk prediction models have been developed for use in the acute stroke, however the outcome measures (OM) used are variable. In response to known OM variability, an interdisciplinary standardized assessment battery (ISAB) was developed with recommendations of the American Physical Therapy Association (APTA) neurology section task force for stroke OM use. The aims of this study were to examine potential predictors for falls in patients with acute stroke during an IRF stay, and to establish cut off scores for OM’s that were able to predict fallers.

Number of Subjects: 142

Materials/Methods: 140 patients with 142 acute strokes underwent an ISAB at IRF admission. A REDCap database captured the summated scores and SAS 9.3 was used for statistical analysis. Fall that occurred during the IRF stay were identified with a retrospective chart review. Logistic regression model with correlated data using generalized estimating equations (GEE) method was used to investigate which factors predict falling during the IRF stay. The primary predictors considered at admission were National Institute of Health Stroke Scale score (NIHSS), NIHSS item 11 (hemineglect), Berg Balance Scale (BBS), Stroke Rehabilitation Assessment of Movement (STREAM) total and lower extremity subscale (STREAM LE), Montreal cognitive assessment (MOCA) and Dynamic Gait Index (DGI).

Results: 23 patients (16.2%) fell during the IRF admission. There was no significant difference between fallers and non-fallers in terms of age, gender, stroke type and stroke location. The only factor that achieved significance was the STREAM LE. A one unit increase on STREAM LE at admission decreased the odds of falling during the IRF stay by 7% (OR=0.93, p=0.0421). ROC analysis using STREAM LE was used with the area under curve (AUC) being 0.6471. Youden index was used to select the optimal cut-off point of 12 to differentiate fallers and non-fallers with a sensitivity for predicting falls of 77.3% and specificity of 50%. STREAM LE and BBS were used together in the model to predict falls. The AUC for these two predictors combined was 0.6478, which is not significantly different from the AUC for STREAM LE subscale only (p=0.9223).

Conclusions: STREAM LE score at admission can differentiate fallers from non-fallers in patients with acute stroke admitted to an IRF. STREAM LE score lower or equal to 12 indicates an increased risk for falling during the IRF admission. Including the BBS with the STREAM did not improve ability to predict fallers.

Clinical Relevance: OM’s are routinely used in the rehabilitation assessment of patients with acute stroke to predict fall risk. Use of the STREAM LE score may assist with predicting those who will fall during an acute rehabilitation admission. Including STREAM LE into the IRF admission exam may assist clinicians with implementation of improved fall prevention protocols.
Impact of Postural Control, Circuit, and Aquatic Physical Therapy in a Group Setting on Three Pediatric Patients with Familial Friedreich’s Ataxia

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R. Studer-Byrnes, C.R. Senesac, Physical Therapy, University of Florida, Gainesville, Florida, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Friedreich's Ataxia (FA), the most common of the inherited ataxias, is a progressive, autosomal recessive, neurodegenerative disorder. There is currently no known cure or viable treatment option for FA patients although therapeutic strategies are used to decrease the rate of progression of the disease. Little to no studies exist discussing group therapy with pediatric patients diagnosed with FA, let alone discuss circuit training and postural control exercises. The purpose of the present case series is to describe the impact of group physical therapy including postural control, aquatic therapy, circuit and endurance training, and coordination activities on three pediatric patients with FA.

Case Description: Three consecutive brothers were referred from a neurologist to Neuroworx outpatient neuro clinic all with a clinical diagnosis of FA with no previous physical therapy treatment. All subjects were independent with ambulation and had minimal to moderate difficulties with activities of daily living.

Outcomes: Berg Balance Scale was used to assess static and dynamic balance, ataxic impairments were identified using the Scale for Assessment and Rating of Ataxia (SARA), and gross motor skills were measured with Gross Motor Function Scale (GMFM-88). Each participant was administered the above outcome measures at re-assessment (beginning of studied interventions) and at 4-month follow-up. All outcome measures remained stable and indicated no significant increase or decrease over the course of treatment.

Discussion: Since there was no decline in function detected in the outcome measures over the course of 10 months, this suggests that the interventions were a successful maintenance program. Limitations of this case study include potential ceiling effect with outcome measures and including participants from the same age group.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: Error augmentation training as an intervention for walking in individuals with chronic stroke: A systematic review of literature


ABSTRACT BODY:

Purpose/Hypothesis: Many individuals with chronic stroke continue to demonstrate gait deviations (errors) which impair their ability to achieve optimal function. Traditional physical therapy has focused on reducing these errors in order to achieve a more normalized gait pattern. However, emerging research suggests the opposite, that augmentation of errors may also help normalize gait. The aim of this systematic review of the literature was to determine if error augmentation training can serve as an effective intervention to improve walking in individuals post-stroke.

Number of Subjects: 8

Materials/Methods: A systematic search of the literature was completed in accordance with the PRISMA guidelines using the PEDro scale to assess for risk of bias. Three databases were searched with the following search terms: stroke, error, adaptation, resistance, and walk*. Inclusion criteria included: humans, adults, and chronic stroke. The exclusion criteria were cerebellar stroke and upper extremity foci.

Results: The eight studies included in this review had an average PEDro score of 4.13(+1.13). Across these studies, error augmentation was addressed in different ways: step length asymmetry (via split-belt treadmill or swing-phase weighted resistance), hemiparetic foot drop (via a robotic ankle-foot orthosis), and hemiparetic ankle movement in the sagittal plane (via robotic exoskeleton). In all cases, regardless of the deviation targeted or experimental set-up, a single bout of error augmentation training consistently resulted in an improvement of the deviation immediately following training. However, these positive gait changes were short-lived (seconds-minutes) unless subjects were repeatedly exposed to the error augmentation protocol.

Conclusions: Although short-term improvements in targeted gait deviations are possible after a single bout of error augmentation training, it remains unclear how these positive results can be effectively transferred into today’s clinical setting. Research shows that precision of the error stimulus is essential for success, but the equipment used is not readily available in most clinics. Even though preliminary evidence for repeated exposure is positive, it remains unclear how to appropriately dose this particular treatment, and how frequency of exposure will impact the effects on gait. Furthermore, this type of treatment has only been successfully demonstrated within a small, precise patient population: survivors of chronic stroke who are independent ambulators with a single, stable gait deviation.

Clinical Relevance: Currently, there is insufficient evidence to recommend the use of error augmentation in clinical settings for individuals with chronic stroke. While error augmentation has the potential to be a powerful tool to improve gait deviations that are otherwise resistant to change, there are too many unanswered questions at this time. We recommend clinicians closely follow this line of research, as it may hold immense potential to induce positive changes in common post-stroke gait deviations.
**Title:** A comparison of two FDA approved validated devices that provide multidimension quantifiable gait parameters in people with multiple sclerosis (PwMS)

**Authors/Institutions:** C. Burke, Physical Therapy, SUNY Stony Brook, Stony Brook, New York, UNITED STATES | M. Gudesblatt, S. Trebing, Neurology, South Shore Neurologic Assoc, Patchogue, New York, UNITED STATES

**Abstract Body:**

**Purpose/Hypothesis:** To compare objective quantified outcome parameters produced by devices utilizing different validated technology.

**Number of Subjects:** 23

**Materials/Methods:** People with multiple sclerosis (PwMS) performed 25-foot walk on GAITRite mat while simultaneously wearing a G-walk device. Univariate regression modeling evaluated relationships between 11 outcome parameters produced by both devices. Relationships were grouped by correlation strength; high (r>0.50), medium (0.30<r<0.49), low (r< 0.29).

**Results:** 23 PwMS (52% female, average age - 51.7 +/-11.5 years, EDSS 2-6.5) Gait domains (GD) analysis revealed: 67% high-strength correlations: swing-phase duration left leg (r=0.62, p<.01), % gait cycle single support right leg (r=0.54, p<.01), % gait cycle double support left leg (r=0.69, p<.001), cadence (r=0.91, p<0.001); 9% medium strength correlations: swing-phase duration right leg (r=0.44, p<.05); and 27% low strength correlations: % gait cycle single support left leg (r=0.22, p>0.30), % gait cycle double-support right leg (r=0.23, p>0.20) and velocity (r=0.20, p>0.30).

**Conclusions:** Objective quantified gait parameters obtained by different technologies might provide discordant/insensitive results despite "measuring" equivalent outcomes. 67% of parameters had strong correlations between devices, 33% had medium or low correlations including gait velocity. Discrepancies raise concerns regarding data validity produced by one/both devices utilizing varied technology and across devices/disability comparisons. Identifying optimal devices and if specific groups of disability compromises ability to capture valid/reliable data.

**Clinical Relevance:** MS is a disease characterized by relapses/progressions which commonly impacts ambulation. Impaired ambulation in PwMS causes disability. Current approaches to documenting gait impairment includes EDSS and 25 foot walk. These outcome measures are insufficiently sensitive to quantify critical changes. This information is important to identify disease severity, fall risk, improvements in therapy and efficacy of disease modifying therapies. Objective analyses approaches have included digital devices of varying types utilizing different transducers (e.g. foot pressure, accelerometer). Comparing different technologies in PwMS with varying disability levels is important to determine optimal technology approach.
ABSTRACT BODY:

Purpose/Hypothesis: Researchers have investigated the benefits of surface electromyography (EMG) recording as a part of the assessment and treatment for adults and children with neurologic conditions, but there has not been a major uptake of this technology in clinical practice. The purpose of this study was to explore the perceived value, benefits and drawbacks, and ideas for future design and implementation of EMG systems from a variety of stakeholder perspectives.

Number of Subjects: 22

Materials/Methods: In-depth, semi-structured interviews or focus groups were carried out with 22 physical therapists, occupational therapists, and physiatrists with a mean of 14.5 years of experience (SD=14.1) from four major metropolitan hospital systems. During each research encounter, a brief demonstration of four commercial or lab-designed EMG systems was provided to garner perceptions of specific system features. Interviews and focus groups were audio-recorded, transcribed verbatim, then coded for analysis.

Results: The interviews and focus groups revealed four major themes. 1) Low-tech clinical practice: Clinicians do not routinely incorporate EMG technology into their practice, experience with EMG systems was limited to research environments; 2) Barriers to EMG uptake: Clinicians perceive limited time and financial resources with patients, the danger of losing expensive equipment, and set-up/training time as barriers to EMG implementation in the clinic and for home use; 3) Benefits of EMG: EMG tracking may enhance evidence-based neurorehabilitation, be motivating for patients during treatment, and improve functional outcomes and carryover beyond the clinic or hospital; and 4) Essential features of EMG systems: Clinicians consider quick set up, real-time tracking, minimal skin preparation, water-resistance, wireless, low-profile, low cost, and reimbursable as essential features of EMG systems.

Conclusions: Surface EMG systems are not routinely used by therapists in inpatient or outpatient settings for assessment or treatment of muscle activity following neurologic injury. Despite recognition of potential clinical benefits of EMG use, key barriers to implementation were identified. Clinician perspectives on design and EMG system features indicate the need for a low-maintenance, streamlined, intuitive, and clinically impactful application that is not yet achieved by current systems.

Clinical Relevance: Wearable sensor technology has become mainstream for people to track fitness and activity, but current technology is not well linked to more specific rehabilitation needs and outcomes. Surface EMG systems have the potential to inform clinical practice, but to achieve uptake by clinicians and patients, sensors and interfaces must be accurate, intuitive, unobtrusive, and generate feedback that is meaningful and accessible to all stakeholders. This research provides insights on how EMG systems may be improved, and how their clinical benefits may be harnessed by designers, engineers, and clinicians to improve recovery and community participation after neurologic injury.
Title: Predicting walking activity in Parkinson's disease

Authors/Institutions: T. Ellis, Physical Therapy & Athletic Training, Boston University, Boston, Massachusetts, United States; R.A. Martin, G. Fulk, Physical Therapy, Clarkson University, Potsdam, New York, United States; J.T. Cavanaugh, Physical Therapy, University of New England, Portland, Maine, United States; L. Dibble, K.B. Foreman, Physical Therapy, University of Utah, Salt Lake City, Utah, United States; G.M. Earhart, Washington University in St. Louis, St. Louis, Missouri, United States; C. Fulk, St. Lawrence University, Canton, New York, United States; M. Ford, Samford University, Birmingham, Alabama, United States.

Abstract Body:

Purpose/Hypothesis: Measuring steps per day is a common way of defining an individual's level of physical activity. Walking activity categories have been proposed for the healthy population and for some neurologic populations, but not specifically for individuals with Parkinson's disease (PD). The purpose of this study was to determine if gait-related outcome measures could predict walking activity for individuals with PD based on real-world activity monitor data.

Number of Subjects: 99 participants with idiopathic PD, with a mean age of 67.4 years, mean years with symptoms of 8.1, and mean modified Hoehn Yahr of 2.3.

Materials/Methods: Cross sectional secondary data analyses were completed from a PD progression study. Walking activity categories were established from activity monitor data from population based recommendations of Tudor-Locke et al and included sedentary (>5,000 steps/day), low-somewhat active (5,000-9,999 steps/day), and active (>=10,000 steps/day). Average steps/day of participants was determined using a StepWatch Activity monitor worn for one week. Gait related outcomes included the 6-minute walk test (6MWT) and self-selected gait (GS) measured over a 10-meter walk. Receiver operator characteristic (ROC) curves were calculated for both 6MWT and GS to determine the ability of gait related outcomes to distinguish between the different walking activity categories.

Results: The 6MWT was a good predictor of sedentary vs. low-somewhat active and active participants (ROC area under the curve [AUC]=0.81) and low-somewhat active vs. active participants (ROC AUC=0.76). A 6MWT distance of 405.5 meters could distinguish between sedentary vs. low-somewhat active and active walkers. A 6MWT of 475 meters could distinguish between low-somewhat active vs. active walkers. GS was a fair predictor of sedentary vs. low-somewhat active and active participants (ROC AUC=0.71); and low-somewhat active vs. active walkers (ROC AUC=0.61). A GS of 1.21 m/s could distinguish between sedentary vs. low-somewhat active and active walkers. A GS of 1.25 m/s could distinguish between low-somewhat active vs. active walkers.

Conclusions: The 6MWT demonstrates better ability to distinguish among different levels of walking activity than GS. Interventions to improve walking endurance may increase walking activity in people with PD.

Clinical Relevance: Clinicians and researchers can use the 6-minute walk test to categorize walking activity of individuals with PD. The 6MWT cut off values established could be used to set goals and monitor the impact of disease progression on walking activity.
Purpose/Hypothesis: Balance-Based Torso-Weighting (BBTW) has been reported to acutely improve static and dynamic balance in people with multiple sclerosis, including those with ataxia. People with degenerative ataxia have decreased motor learning due to cerebellar damage but show improved static and dynamic postural control after participation in a physical therapy exercise program. The aim of this descriptive pilot study was to investigate the immediate effects of the BBTW system on balance and walking of people with degenerative ataxias.

Number of Subjects: 5

Materials/Methods: Subjects (4F, 1M; Mean age 58.2 ± 14.8 yrs) were recruited from local ataxia support groups, had Spinocerebellar ataxia (n=4) or Friedreich’s ataxia (n=1) and could walk independently for moderate distances. Subject ataxia was rated using the Severity of Ataxia Rating Scale (SARA). A pressure-sensing walkway (ProtoKinetics Zeno Mat) captured postural sway (10 seconds of self-selected stance with eyes open and closed) and gait (self-selected pace). Subjects were assessed prior to and following the application of BBTW (Motion Therapeutics BalanceWear vest). After baseline data capture, subjects were fitted by the same BBTW-trained physical therapist (JLP) using the BBTW protocol. Small weights totaling between 0.51 and 0.91 Kg (avg 1.6% of subject bodyweight) were affixed to the vest to counteract balance discrepancies. Subjects acclimatized to the vest by walking 5 min at a self-selected pace, rested briefly then balance and gait tests were repeated.

Results: All subjects reported increased balance confidence in the Romberg position after application of BBTW. Objective data were extracted using PKMAS (ProtoKinetics Ver 508c2). Descriptive data revealed a bimodal pattern of responders (3 subjects; SARA scores of 4, 10 and 10.5) vs non-responders (2 subjects; SARA scores of 13.5 and 15.5). In responders, BBTW produced a reduction in eyes-open anterior-posterior (A-P) sway range (0.69 ± 0.07 cm) and increased gait cadence (4.65 ± 1.22 steps/min), velocity (10.04 ± 1.08 cm/sec), and stride length as % of baseline (10.29 ± 9.63 %). In non-responders, BBTW produced a limited improvement in eyes-open A-P sway range (0.29± 0.02 cm) but reductions in gait cadence (-3.22 ± 3.01 steps/min), velocity (-6.37 ± 6.32 cm/sec) and stride length as % of baseline (-6.35 ± 3.36 %).

Conclusions: Descriptive data from our small sample were encouraging. In people with degenerative ataxia and a SARA score of 10.5 or less, BBTW produced an immediate positive effect on balance and gait. Subjects with more severe ataxia had a negligible or negative acute response. Our observations must be confirmed and statistically tested on a larger sample. Questions remain about changes in impairments, function or participation following chronic use of BBTW.

Clinical Relevance: Immediate improvements in static and dynamic balance with the use of BBTW may promote effective participation in a physical therapy plan of care. The increased confidence and balance imparted by BBTW may reduce risk of falls and improve walking patterns.
Speed-Focused, Intermittent Exercise Improved Function in a Person with Multiple Sclerosis and Limited Medical Intervention

R.E. Canfield, J. Francois, J. Freund, Elon University, Elon, North Carolina, UNITED STATES

Background & Purpose: Multiple Sclerosis (MS) is a progressive disease of the central nervous system with varied symptoms such as: muscle weakness, gait difficulty, spasticity, cognitive changes, depression and bladder problems. Although there is no cure for MS, medications may modify the course of the disease and physical therapy may improve function. In many developing countries, people with MS often have delayed diagnosis and do not receive disease modifying medications or physical therapy. The purpose of this case report is to describe the effects of speed-focused intermittent exercise to improve function and decrease burden of care in a person with MS after many years of minimal medical or rehabilitation intervention.

Case Description: The patient was a 43-year-old male diagnosed with MS 8 years prior, although symptoms began 6 years before diagnosis. He lived in Pakistan and received no disease modifying medication or physical therapy until moving to the United States 3 months earlier. Prior to the current intervention he had 2 months of outpatient physical therapy which he discontinued due to lack of insurance. For this case report he participated in ten one-hour sessions of physical therapy over five weeks as a patient in a university physical therapy course. On initial evaluation he had left upper and lower extremity weakness, gait abnormalities, and fatigue with minimal activity. He used a wheelchair for mobility and walked very short distances with a walker and two person assist. Intervention included speed-focused, intermittent bouts of upper extremity exercise, transfer training, locomotor training (overground and with body weight support on a treadmill), and a home exercise program.

Outcomes: The patient showed meaningful improvement in the following outcome measures (pre-, post-intervention): Function in Sitting Test (FIST) (44/56, 53/56); gait speed (0.08, 0.22 m/s) Functional Ambulation Category (FAC) (0/5, 1/5).

Discussion: After 8 treatment sessions the patient required decreased assistance with transfers, had improved gait and his wife reported decreased burden of care. Improvement in the FIST exceeded the minimal clinically important difference (MCID) for persons with stroke; no established MCID for persons with MS. FAC improvement from 0 to 1 allowed him to walk at home using a walker with his wife’s assistance. This case illustrates functional improvement with speed-focused, intermittent exercise in a person with MS, who had not received disease modifying medications or rehabilitation for many years after diagnosis. It also highlights the need for increased medical and rehabilitation services for people with MS in developing countries.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
Power, Gait Speed and Preparation for High-Level Mobility in Patients with TBI: A Case Study

M.A. McKinney, D.P. Wingard, TIRR Memorial Hermann, Houston, Texas, UNITED STATES

Background & Purpose: Traumatic brain injury (TBI) is a leading cause of disability in adolescents. These individuals demonstrate slower gait speeds and reduced ability to engage in age-appropriate play. Return to higher-level mobility, like running, is often a goal for individuals following TBI. After TBI, individuals who walk at a self-selected speed greater than 1.0 m/s are 16.9 times more likely to be able to run. Additionally, young stroke survivors are nearly three times more likely to return to work if they are able to run, even if only for a few steps.

Minimal literature exists on effective interventions for returning individuals with TBI to high-level mobility. The ability to perform four tasks (bounding onto a leg, walking on toes, stepping backwards up a step and balancing on one leg) have been shown to be strong predictors of running ability in persons with TBI. Training these tasks in preparation for rehabilitation of running has not been investigated in the literature.

Case Description: The patient was a 15-year-old male who presented to outpatient rehabilitation following an anoxic brain injury. Nine months after his initial injury, the patient underwent a comprehensive physical therapy (PT) program 4 times a week for 5 weeks. Two days a week were focused on improving power and strength and the other two days were focused on increasing gait speed and improving motor control and balance. Three out of four sessions ended with fast over ground gait training.

Outcomes: Gait velocity was measured using the 10 Meter Walk Test. After five weeks of training, the patient improved his self-selected gait speed from 0.83 m/s to 0.95 m/s (MCID= 0.15 m/s) and he improved his fastest-comfortable gait speed from 1.07 m/s to 1.46 m/s (MCID= 0.25 m/s). Additionally, the patient improved his broad jump from 14.5” to 21”. Functional gait assessment score increased from 17 to 20 (MDC= 5 points).

At the end of the intervention period, the patient was still unable to fully complete all four motor tasks predictive of running ability. During running attempts he was unable to achieve a flight phase.

Discussion: Returning to high-level mobility for adolescents following TBI is an important goal for patients and their families. Few studies exist describing and detailing effective interventions in rehabilitation of high-level mobility. This case study provides evidence that a comprehensive PT program with focus on improving power and gait speed can be effective in improving jumping ability and gait speed in an adolescent with a TBI. Despite improvements in gait speed and jumping ability, the patient was unable to perform all four motor tasks at the end of the intervention phase or perform running. This was likely due to continued difficulty with single limb balance in static and dynamic positions. Utilizing the four motor tasks that were predictive of running ability allowed for the PT to develop a plan of care, create a specific home exercise program and provide concrete, evidence-based goals for appropriate discharge and resumption of outpatient PT.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: “Y” Balance Test Using a Force Plate in High School Athletes

AUTHORS/INSTITUTIONS: L. Lowe, J. Baker, S. Codemo, J. Kordsmeier, K. Garrison, Physical Therapy, University of Central Arkansas, Conway, Arkansas, UNITED STATES

ABSTRACT BODY:

Purpose: The purpose of this project is to explore the use of a novel approach to capture reach data using the Y Balance Test (YBT) derived from the Star Excursion Balance Test (SEBT) with concurrent center of pressure (COP) data using force plate technology.

Description: The current three-prong approach to concussion management utilizes a static balance test, the Balance Error Scoring System (BESS), that may not adequately assess the demands of dynamic athletic play. The YBT is an established, reliable outcome measure of dynamic postural stability through measurement of lower extremity reach distance. Additionally, a recent study concluded that postural sway variability analyses applied to COP data obtained through use of a force plate may be a more valid measure of deficits in postural control post-concussion than the BESS for young athletes. The combination of the YBT and force plate technology for COP capture during this dynamic test has not been reported in the literature, nor have these combined methods been used in high school athletes.

Summary of Use: High school male football players (n=131) performed the YBT while standing on a portable force plate. A customized frame with built-in pressure sensors automatically determined reach distance in each standardized direction. The best of three attempts in each reach direction was selected for each athlete for both dominant and non-dominant legs. The 95% ellipse area, reach distance (normalized by leg length), and ellipse major axis was determined. The 95% ellipse area for one school (n=51) had a mean area of 7.0355 cm² (SD 4.21). And, the mean of the major axis was 2.904 cm (SD 0.759).

Importance to Members: Reach distance has been shown to be decreased in athletes with chronic ankle instability and has been shown to be a predictor for lower extremity injury in high school basketball players. This pilot study is the first to collect reach data using the YBT with concurrent COP data. By capturing these data concurrently, clinicians will have a more comprehensive picture of the postural strategies the athlete is using to achieve dynamic balance success. The data from this study will also contribute to forming normative values for the YBT in the developing adolescent male that have not been reported in the literature. Additionally, this innovative approach will promote the development of clinical ranges regarding COP during a dynamic test, the YBT, that more closely mimics the demands of athletic play. These values will ultimately help us better explore residual effects of concussion and other injuries on balance in adolescents.
Background & Purpose: Dizziness is a common complaint among patients seen in physical therapy clinics. Dizziness can be caused by a plethora of diagnoses or impairments. Common causes of dizziness can be caused by dysfunctions of the vestibular system, cardiovascular system, central nervous system, cervical spine, or medications. An uncommon cause of dizziness is the temporomandibular joint (TMJ). Therapists may not often recognize the TMJ as a possible cause of dizziness, given both the paucity of literature on the topic and the vast number of other causes which manifest as dizziness. The purpose of this case report is to discuss the possibility of patients who are dizzy presenting with TMJ dysfunction.

Case Description: The patient (pt.) is a 70-year-old female presenting with a primary complaint of 8/10 dizziness at worst. Pt. described dizziness as lightheadedness and dizziness during position changes but also persisting while lying supine. Pt. also has complaints of imbalance while walking and intermittent tinnitus and temporal headaches. Pt. demonstrated an unconscious frequent rapid right lateral jaw deviation. Both the dizziness and headaches had been persisting for about five years and started around the same time as she received ill-fitting partial dentures. Orthostatic testing, oculomotor screen, cervical spine screen, Dix-Hallpike, Roll-test, and head thrust test were negative. Dynamic visual acuity (DVA) was positive, and TMJ lateral deviation was decreased to the left 6mm when compared to the right, and there was tenderness to palpation of her right medial and lateral pterygoids which reproduced her dizziness. Pt. was prescribed vestibular ocular reflex x1 viewing exercises, self-soft tissue massage to her right pterygoids, and general balance exercises. Pt. was also told to place tape on the left side of her face as a cue to perform the jaw deviation less.

Outcomes: Pt. was seen for a total of 9 visits and reported herself as 70% recovered. Without the tape on her face she performed the jaw deviation 50 times in 5 minutes in the clinic. With the tape placed while in clinic she performed jaw deviation 25 times in 5 minutes. On re-evaluation testing 4 weeks later she reported 0/10 dizziness for one week. DVA testing was negative and The Activities Specific Balance Test improved from 57.5% to 76.25%. The Functional Gait Assessment was improved from 13/30 to 19/30. The timed up and go improved from 16.5 to 10.83 seconds. Gait speed improved from 1.6 to 0.96 m/s.

Discussion: This case illustrates the importance of screening the TMJ when a patient complains of dizziness. In this case, it was clear there may be a potential TMJ dysfunction due to unconscious lateral jaw deviation. However, in other cases, TMJ dysfunction can be present without obvious signs (e.g. Bruxism). This case exemplifies that TMJ dysfunction can manifest as a dizziness. Clinicians should consider TMJ as a source of dizziness when other findings are negative.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Dickerson S., Weaver J., Boyson A., Thacker J., Junak A., Ritzline P., Donaldson M. The Effectiveness of Exercise Therapy for Temporomandibular Dysfunction: A Systematic Review and Meta-Analysis. Clinical Rehabilitation. 2016; 1-10


TITLE: The Effects of Recruitment of Jaw Musculature on Dynamic Postural Control

AUTHORS/INSTITUTIONS: M. Taylor, T. Chung, R. De Lima, A. Mitterling, N. Ugharadar, J.L. Woitte, University of Mary, Bismarck, North Dakota, UNITED STATES |

ABSTRACT BODY:

Purpose/Hypothesis: Recent research has examined the influence of the jaw sensory-motor system on static postural control in adults. Different variables/conditions have been investigated including activation of jaw musculature with clenching and chewing, fist clenching, tongue position as well as varying base of support and visual input. These studies have shown that there is a link between the jaw sensory-motor system and static stability. The correlation between recruitment of jaw musculature and dynamic postural control has not been investigated. This type of control is a critical component of functional tasks. Therefore, the purpose of this study was to investigate the effects of recruitment of jaw musculature on dynamic postural control in healthy young adults. Our hypothesis was that participants using jaw clenching would have significantly better dynamic balance (as measured by a force platform) when compared to using a resting jaw position.

Number of Subjects: Thirty-three healthy subjects (15 males, 18 females) ages 18 to 30 years participated in the study. The sample population of previous studies included only healthy male subjects. Inclusion of both genders in this study was vital to appropriately represent the general population.

Materials/Methods: The NeuroCom Balance Master® force platform system was used to calculate percentage of directional control and on-axis velocity during the Rhythmic Weight Shift Test (RWST) as a measure of dynamic postural control for each participant. The RWST quantifies an individual’s movement velocity and directional control by testing one’s ability to move their center of gravity (COG) between two targets while attempting to maintain their COG on a cursor at three distinct speeds (slow, moderate, fast). All participants performed the RWST with jaw musculature relaxed on one day and then clenched at a moderate level on a separate day (randomized order).

Results: Participants performed significantly better with jaw clenched vs. relaxed when performing lateral weight shifts at a slow speed and with anterior-posterior weight shifts at a moderate speed. Statistical significance was also achieved when averaging all 3 speeds (composite score) during lateral weight shifts with jaw clenched vs. relaxed position. Although not all were statistically significant, the results of this study show that 6/8 clinical trials demonstrated an improved score with jaw clenched vs. jaw resting position.

Conclusions: Based on the results of this study, jaw clenching appears to improve aspects of dynamic postural control in healthy young adults.

Clinical Relevance: The researchers expect greater improvement in the RWST when applying the same test to individuals with balance impairments. Recruiting jaw musculature is easy and safe to have a patient attempt during a treatment session. It also takes a minimal amount of time to assess if it improves overall function. Future studies should compare the effect of jaw clenching on dynamic postural control in different populations, especially those individuals with documented balance deficits.
TITLE: Aerobic Capacity and Body Composition in Spinal Muscular Atrophy: A Case-Control Study

AUTHORS/INSTITUTIONS: S.P. Andrew, D.C. De Vivo, Neurology, Columbia University, New York, New York, UNITED STATES|M. Lea, S.L. Emily, J. Montes, Rehabilitation and Regenerative Medicine (Physical Therapy), Columbia University Medical Center, New York, New York, UNITED STATES|A.K. Rao, Rehabilitation & Regenerative Medicine (Physical Therapy), Columbia University, New York, New York, UNITED STATES|C.E. Garber, Biobehavioral Sciences, Teachers College, Columbia University, New York, New York, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Individuals with spinal muscular atrophy (SMA) have hypotrophic myofibers, muscle weakness, and fatigue due to SMN protein deficiency1. While motor neurons are known to be selectively vulnerable to SMN insufficiency, evidence suggests that muscle mitochondrial biogenesis also may be affected2. SMA patients have reduced oxidative capacity3, which may represent a functional correlate of mitochondrial depletion. In healthy individuals, fat free mass (FFM) is associated with oxidative capacity4,5. In SMA, FFM is reduced6 and is associated with muscle volume7, but its relationship to oxidative capacity is not known. In order to evaluate the physiological implications of muscle mitochondrial impairment in SMA, the impact of muscle atrophy and reduced FFM must be understood. The purpose of this study was to examine the relationship between oxidative capacity and body composition in SMA. We hypothesize that: [1] FFM is associated with oxidative capacity (VO2 max) both in SMA and controls and [2] FFM of the lower body has a greater influence on VO2 max than FFM of the whole body both in SMA and controls.

Number of Subjects: 6

Materials/Methods: There were 3 participants with SMA (mean 39.3, range 16 – 53 years) and 3 age-matched controls, (mean 39.0, range 17 – 52 years). Assessments included body composition using Dual-Energy X-ray Absorptiometry to determine FFM and aerobic capacity using a ramped maximal exercise tolerance test on a recumbent ergometer (VO2 max). Endurance and strength were assessed with 6-minute walk test (6MWT) and manual muscle testing (MMT). Descriptive statistics and independent samples t-tests were used to compare SMA patients to controls on measures of body composition, aerobic capacity, endurance, and strength. Pearson correlation coefficients were used to evaluate the relationship between oxidative capacity and body composition.

Results: SMA patients had significantly less whole body FFM; 54.3% (p=0.045) and lower body FFM; 47.6% (p=0.021) compared to controls. VO2 max was reduced in SMA (15.03 mL/L/min) compared with controls (41.43 mL/L/min) (p=0.043). Between group differences were seen in the 6MWT (p=0.017) and MMT composite score (p=0.026). For all participants, there was a positive association between whole body FFM and VO2 max (R=0.863; p=0.027). The association between lower body FFM and VO2 max was more robust (R=0.925; p=0.008).

Conclusions: These findings support the hypothesis that whole body FFM is associated with oxidative capacity. Furthermore, lower body FFM is more closely associated with oxidative capacity than whole body FFM in all subjects perhaps because of a greater muscle mass in the legs or the increased demand of leg muscles during cycle ergometry.

Clinical Relevance: Understanding the relationship between body composition and oxidative capacity allows further study into the physiological implications of muscle mitochondrial impairment. Altogether, this can provide insight into rehabilitative strategies for individuals with SMA. Further research is needed to establish why this relationship occurs on a physiological level.
TITLE: Functional outcome measure use in the examination and treatment of patients following mild traumatic brain injury (mTBI): a national survey of physical therapy clinicians


ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study is to survey practicing physical therapy clinicians (PTs) to identify the frequency and comfort of utilizing functional outcome measures (FOM) in the examination and treatment of patients following a mTBI in the clinical setting. In addition, this study also surveys the desire for a comprehensive tool to measure function following a mTBI in physical therapy practice.

Number of Subjects: 324 PTs

Materials/Methods: A 17-question electronic survey was created using Qualtrics Software and distributed via email and social media targeting PTs currently treating patients following mTBI. Information about professional and personal demographics in addition to FOM and comfort were collected. FOMs included the Balance Error Scoring System, Modified Clinical Test of Sensory Organization and Balance (mCTSIB), Dynamic Gait Index (DGI), Functional Gait Assessment (FGA), High Level Mobility Assessment Tool, Four Square Step Test, BBuffalo Concussion Treadmill Test, 6-minute Walk Test (6MWT), Walking and Remembering Test (WART), and Modified Timed Up and Go (mTUG).

Results: Of the 324 consented participants, 51.89% have greater than ten years of experience as a physical therapist, however 73.58% have less than ten years of experience treating patients with mTBI specifically. The most frequently used FOM reported is the mCTSIB, with 28.03% selecting they “always” use the mCTSIB. Of the participants, 20.7% “always” use the FGA, while 20.71% “never” use the WART for patients following mTBI. Greater than 15% of participants feel “expert” comfort with the use of the 6MWT, mTUG, and DGI. Ninety-four percent of participants answered “yes” to having interest in a comprehensive functional outcome measure to examine function in a patient following a mTBI.

Conclusions: The FOMs identified by participants and researchers can be classified as examining static balance, dynamic balance, dual tasking, and activity tolerance. The most frequently used static balance measure is the mCTSIB, while the most frequently used dynamic balance measure is the FGA. Dual task and activity tolerance measures are not identified as being used frequently in physical therapy clinical practice. Overwhelmingly, physical therapists identified the desire to have a comprehensive functional outcome measure for examining patients following mTBI.

Clinical Relevance: Variability in the examination and treatment of patients following mTBI is evident based on the results of this study. PTs are frequently utilizing FOMs that assess static and dynamic balance in the examination and treatment of patients following mTBI. PTs may need to be informed of FOMs available in patients with mTBI who are having limitations in dual tasking or activity tolerance. In the clinical setting, physical therapists should make informed clinical decisions when choosing a FOM based on reliability, validity, and appropriateness of each test depending on patient presentation.
TITLE: Computerized Dynamic Posturography Comparing the Bertec Balance Advantage™ and Neurocom Smart Balance Master® in Assessing Postural Stability in Healthy Adults

AUTHORS/INSTITUTIONS: P.R. Trueblood, C. Bentley, M.J. Rivera, Physical Therapy, California State University, Fresno, Friant, California, UNITED STATES|N. Wubenhorst, Physical Therapy, San Joaquin Rehabilitation Hospital, Fresno, California, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study is to establish the validity of postural stability measures between a new computerized dynamic posturography (CDP) system Bertec™ using an immersive virtual environment to the gold standard sway-referencing of NeuroCom®.

Number of Subjects: 50

Materials/Methods:

50 healthy adults aged 20-69 years old were tested on the 3 protocols for CDP: Sensory Organization Test (SOT), Motor Control Test (MCT), and Adaptation Test (ADT).

Results: Both the MCT and SOT composite and conditions 2, 4, 5 and 6 on the SOT exhibited strong to moderate correlation values between Bertec™ and NeuroCom® (r=.57-.81), indicating good concurrent validity. Poor correlation values for ADT toes up and toes down indicating poor concurrent validity. Condition 1, 4, 6 and SOT composite equilibrium scores were significantly lower in Bertec™ MCT composite latency scores were significantly longer and ADT toes up and toes down sway energy scores were significantly higher on Bertec™. All scores indicated less stability observed on the Bertec™ versus the NeuroCom®. The largest clinically important difference was found in Condition 4 on the SOT and the ADT.

Conclusions: CDP tests of SOT and MCT showed high levels of concurrent validity indicating that both Bertec™ and NeuroCom® are valid measures of postural stability.

Clinical Relevance: With somatosensory and vestibular ratio scores comparable, it gives clinicians confidence both devices are reliable in measuring somatosensory and vestibular cues for balance. Significantly lower vision ratio scores on Bertec™ as compared to NeuroCom®, suggest the immersive virtual environment of Bertec™ may provide a more sensitive analysis of visual input into postural stability.
Purpose/Hypothesis: Concussions (mild traumatic brain injury- mTBI) affect all age groups resulting in significant medical ramifications and cost. Much of the current research has focused on sports related concussion prevention/management with less focus on the young pediatric and geriatric populations.

Purpose: To review the current literature on common outcomes observed in post-concussive patients of various age groups in order to direct patient care.

Number of Subjects: N/A

Materials/Methods: A comprehensive electronic search of literature was performed using the following databases: Academic Search Complete, CINAHL, the Cochrane Library, Google Scholar, MEDLINE, PEDro, ProQuest Health and Medicine Collection, and Pubmed. Search terms included “concussion”, “falls”, “tbi”, “traumatic brain injury”, “children”, “pediatric”, “adolescent”, “adult”, “geriatric”, “elderly”, “neuroplasticity”, “physical therapy”, “physiotherapy”, “intervention”, “management”, “outcomes”, “quality of life”, “assessment”, “recovrey”, “return”, “lifespan”, “rehabilitation”, “rehab”, “injury”, “trauma”, and “results”. Abstracts of articles were reviewed for relevance. Articles were then examined for inclusion and exclusion criteria. The STROBE scale was used to determine the quality of the studies.

Inclusion criteria: Published between 2002 and 2017; Peer-reviewed; Published in English language; Studied human subjects, and diagnosis of mTBI.

Exclusion criteria: Case reports; Age range greater than 50 years; Outcomes other than post-concussion and vestibular symptoms, function in activities of daily living, return to play or work duration, symptom duration, hospital length of stay, mortality and quality of life, and Strobe score <17/22.

Results: Sixteen studies were selected for analysis with an average STROBE score of 19.5/22. Only 2 of the studies included children under the age of 4 and only 3 studies included adults up to age 99. Most studies were of adolescents through middle aged adults. Comparison of outcomes was difficult due to the varied number of outcomes between the studies and differences in follow-up times. The most common outcomes described were vestibular dysfunction, headache, cognitive impairment, FIM scores, SCAT scores, RPQ scores, and GCS. Follow-up times varied from 0 to 3 years.

Conclusions: Despite the difficulty comparing the studies, a few trends were present. In children, the presence of headache and trouble sleeping were associated with worse functional outcomes and quality of life, typically missing over 7 days of school and needing 2-4 weeks for recovery.

In teenagers, longer concussion symptom duration was present compared to pre-teens and young adults.

In adults, females were seen to typically have greater severity and frequency of symptoms compared to males.

Older adults have decreased quality of life, take longer to recover, and have lingering cognitive issues. Outcomes in the very young are less described.

Clinical Relevance: Future research should focus on determining optimal prevention and intervention especially for the very young and the very old.
TITLE: Factors associated with healthcare utilization after stroke - a population-based study

AUTHORS/INSTITUTIONS: A. Obembe, B. Shakakibara, J. Eng, Physical Therapy, University of British Columbia, Vancouver, British Columbia, CANADA|L.A. Simpson, Graduate Program in Rehabilitation Sciences, University of British Columbia, Vancouver, British Columbia, CANADA|

ABSTRACT BODY:

Purpose/Hypothesis: More people are surviving stroke but are living with functional limitations that pose daily challenges to individuals and their families. Consequently, the demand on the families and the healthcare system will increase. The purpose of this study was to determine the extent to which stroke survivors use healthcare services from the 2014 Canada Community Health Survey.

Number of Subjects: 34,811

Materials/Methods: This was a cross-sectional survey that collected information related to health status, healthcare utilization and health determinants for the Canadian population. Healthcare utilization was assessed by a computer-assisted personal interview asking about visits to healthcare professionals (family doctor, eye specialist, other specialist doctors, nurse, dental practitioner, chiropractor, physical therapist (PT), psychologist, social worker/counsellor, audiologist/speech or occupational therapist). Binary logistic regression was used to examine the association between healthcare utilization and stroke. Socio-demographic variables, mobility, mood/anxiety disorder and stroke-related comorbid conditions were controlled in the analysis.

Results: The study sample included 34,811 respondents (948 stroke, 33,863 non-stroke) and equate to 12,396,641 (286,783 stroke; 12,109,858 non-stroke) when sampling weights were applied. Generally, the stroke group visited healthcare professionals more than the non-stroke group with the exception of the dental practitioner and chiropractor, which were less. Also, stroke was significantly associated with more visits to the family doctor (odds ratio 1.8 – 2.4; P < 0.05), other medical specialists (odds ratio 1.6 – 2.0; P < 0.05), nurse (odds ratio 2.2 – 2.8; P < 0.05), and social worker/counsellor (odds ratio 2.1 – 3.3; P < 0.05) except the dental practitioner, which was less (odds ratio 0.6 – 0.7; P < 0.05) when socio-demographic variables, mobility, mood/anxiety disorder and comorbid condition were controlled respectively. While the presence of a mood/anxiety disorder or comorbid condition did not change the pattern of PT utilization (odds ratio 1.6; P < 0.05), PT utilization was no longer greater for stroke participants if walking status was accounted for.

Conclusions: Stroke survivors visited healthcare professionals more than people without stroke, and were more likely to consult with those relevant to the management of their stroke. Being able to walk without difficulty decreased the utilization of healthcare services for managing physical problems that arise after a stroke, especially PT.

Clinical Relevance: Community-dwelling stroke survivors, especially those with mobility disorders utilize PT services more than a non-stroke older adult group. It would be important for community PTs to be familiar with the management of stroke, and the impact of stroke-related comorbid conditions.
Intense Balance and Dual-Task Training in a patient with Idiopathic Normal Pressure Hydrocephalus

M. Eikenberry, Physical Therapy Program, Midwestern University, Phoenix, Arizona, United States

Background & Purpose: Idiopathic Normal Pressure Hydrocephalus (iNPH) is a neurologic disorder characterized by gait deviations, cognitive changes and incontinence. The condition is difficult to diagnose and often managed with cerebrospinal fluid (CSF) shunting. The majority of existing evidence surrounds the diagnostic process and surgical management of patients with iNPH. Recent evidence suggests that patients with iNPH may have improvement in gait deviations with shunting alone, however postural instability due to impairments in vestibular function remains following shunt placement. There is very limited evidence guiding the physical therapy (PT) management or rehabilitation potential of these patients and no evidence addressing the potential for vestibular function improvement. This case study will illustrate the application of an intense balance program aimed at improving vestibular function combined with dual task training to improve postural control in a patient with iNPH.

Case Description: A 76 year old male with iNPH was admitted to an inpatient rehabilitation facility (IRF) 4 days status post ventriculo-peritoneal (VP) shunt placement. At IRF admission the patient completed computerized dynamic posturography (CDP) and experienced falls in sensory organization test (SOT) conditions 5 and 6. The patient completed 10 days of PT with 90 minutes of PT/day. PT consisted of vestibular rehabilitation, proactive and reactive balance control activities and application of a dual-task taxonomy to functional tasks.

Outcomes: CDP SOT, Mini Balance Evaluation Systems Test (MBEST), 10 Meter Walk Test (10MWT), Timed up and go and Dual-task Timed up and go (TUG and TUGcog) and Activity Specific Balance Confidence Scale (ABC) were completed at IRF admission and discharge. MBEST improved from 11 to 17/28. 10MWT improved from 0.5 m/s with 29 steps taken to complete to 0.69 m/s with 22 steps taken to complete. SOT composite score improved from 49 to 78 with no falls on conditions 5 and 6 at IRF discharge. ABC improved from 45% to 82%. All of these outcomes reflect clinically meaningful improvements in postural control, gait speed and balance confidence. TUG improved from 23.65 to 19.03 seconds and TUG cog improved from 27.68 to 23.65. Although improved, these scores indicate ongoing risk for falls and dual task interference.

Discussion: These results suggest a benefit for use of intensive balance and dual task training to improve use of vestibular inputs for postural control following shunt placement in this patient. Although the duration of care was limited, clinically meaningful improvements were made. In previous research, patients with iNPH demonstrated ongoing vestibular function impairments at 3 months following shunt placement without rehabilitation, suggesting a positive treatment effect in this patient. Clinicians treating patients with iNPH and VP shunt placement may consider adding CDP testing and intensive vestibular training to the plan of care to improve functional outcomes.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Use of the Brief-BESTest to Assess Balance Impairment and Target Balance Interventions for People with Subacute Stroke: a Pilot Study

AUTHORS/INSTITUTIONS: E. Johns, A.C. Whiting, Good Shepherd Penn Partners, Philadelphia, Pennsylvania, UNITED STATES| C.A. Wamsley, Physical Therapy, Good Shepherd Penn Partners, Levittown, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Previous research has indicated that physical therapy is effective at improving balance, but little has been published about the most effective and efficient interventions to achieve this. Limitations in research are partly due to a lack of standardization of terminology and intervention methodology in the field. The Brief-BESTest has been validated for balance assessment after stroke; however, it also could guide clinicians in their balance plan of care design. This is due to its design around a theoretical construct of six systems of postural control. The authors hypothesized that evidence-based balance interventions focused on the most-impaired systems of postural control, as identified by the Brief-BESTest, will form targeted and feasible physical therapy plans of care among patients with stroke that lead to improved scores at reassessment.

Number of Subjects: 9

Materials/Methods: Subjects were inpatients at an acute rehabilitation facility 7/2016-11/2016, diagnosed with subacute stroke, who could walk at least 20' with or without an assistive device and no more physical assist than contact guard, follow 2 step commands, and had no other neurological diagnoses. Subjects completed the Brief-BESTest within the first week of admission. The subscores were used to determine the balance plan of care. All categories in which they received a score lower than their highest score were included. Interventions were documented in a standardized format, helping ensure consistency and reproducibility. The test was reassessed weekly until discharge. Intervention was 5-7 sessions/week, 10-30 minutes each, focused on the identified systems of postural control. Subjects received no other treatment specific to balance during PT.

Results: 9 subjects were enrolled; 5 of these completed reassessment and therefore completed the protocol. Four subjects did not due to: hemorrhagic conversion (1), chronic pain flare (1), and discharge before anticipated final PT session (2). The 5 subjects who completed the protocol demonstrated variability of subscores on the Brief-BESTest, leading to plans of care including 3 to 5 systems. They also demonstrated improvement in Brief-BESTest scores of 2,1,7,4, and 6 points. They showed improvements in locomotion FIM scores by 5,6,7,6, and 9 points, respectively, and all discharged to the community. Length of protocol varied from 5-16 days, dependent upon the length of stay at the facility.

Conclusions: No previous known studies implemented a standardized balance plan of care for people with stroke, targeting their areas of greatest impairment. Taking a systems approach was found to be a feasible method for providing balance interventions in the subacute stroke population, and warrants further study.

Clinical Relevance: The protocol required minimal equipment and only a portion of the subjects’ PT times, and is realistic for busy clinical environments. Subjects improved in Brief-BESTest scores and locomotion scores by the end of training, although effectiveness cannot be determined due to the small sample size.
TITLE: The physical therapy use of serial casting to gain range of motion and retrain function

AUTHORS/INSTITUTIONS: K. Wing, SWAN Rehab, Phoenix, Arizona, UNITED STATES| K.K. Gatewood, Department of Physical Therapy and Athletic Training, Northern Arizona University Program in Physical Therapy, Phoenix, Arizona, UNITED STATES|

ABSTRACT BODY:

Background & Purpose: Even with the preponderance of evidence that stretching techniques are not effective for the reduction of contracture, serial casting is not routinely used by physical therapists for the treatment of contractures. Factors contributing to this include changes in healthcare reimbursement, lack of training, and the perception that casting is too time and material intensive. The purpose of this case series is to present the robust response to serial casting for the reduction of ankle plantarflexion contractures with subsequent life changing gains in functional mobility of two individuals with right hemiplegia.

Case Description: Case 1: A 42 year old male 9 months post left CVA received 63 sessions of physical therapy in 7½ months before beginning serial casting. In spite of the number of visits he developed a right ankle plantarflexion contracture.

Case 2: A 35 year old male 6 years post left CVA received physical therapy after 4 years of no therapy. He had developed a plantarflexion contracture with excessive pronation, midfoot breakdown, and gait deviations.

Outcomes: Case 1: After 6 casting sessions over 7 weeks his right ankle dorsiflexion improved from -7° to +10° (27° gain). He transitioned from using a solid AFO to a carbon fiber Blue Rocker AFO, he stopped using an assistive device, and no longer used his wheelchair. His 6-minute walk test improved from 540 ft (.46 m/s) with a single point cane to 810 ft (.69 m/s) with no device, and his timed-up-and-go improved from 20.3 sec with a single point cane to 12.8 sec with no device. More powerful were his subjective functional gains: walking was less effortful; balance was improved; sensation improved to the point he could feel stretch, pain, and pressure; and he was able to turn his head while conversing and walking. Because his walking speed improved he was able to participate in activities with his family and return to work part time 2 months after serial casting.

Case 2: After 7 casting sessions his right ankle dorsiflexion improved from -25° to 0°. His AFO was ready for him to use immediately after the last cast was removed. His 6-minute walk test improved from 705 ft (.60 m/s) to 923 ft (.78 m/s), his 10-meter walk improved from 17.0 sec (.59 m/s) to 13.9 sec (.72 m/s), and his timed-up-and-go test changed from 19.8 sec to 13.9 sec. His gait pattern improved so he could walk with almost equal right and left step length. Hip external rotation decreased by approximately 45 degrees, and his base of support decreased to shoulder width.

Discussion: These case studies clearly illustrate the effectiveness of serial casting to reduce plantarflexion contractures after failed stretching interventions. This session reminds therapists that serial casting is a valuable tool for contracture management in patients with a diagnosis of stroke. Because of pre-existing factors, the gains from serial casting alone will not persist without effective long-term management to maintain gains.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Harvey, L. A., Katalinic, O. M., Herbert, R. D., Moseley, A. M., Lannin, N. A., & Schurr, K. (2017). Stretch for the treatment and prevention of contractures. The Cochrane Library
Background & Purpose: Community Based Rehabilitation (CBR) can be broadly defined as specialized, multidisciplinary rehab for individuals living in their home community, and includes outpatient, home health, and residential settings. This heterogeneity makes it challenging to determine the specific parameters that contribute to successful outcomes. The purpose of this study was to explore the effects of one particular CBR program on functional mobility, and participation for an individual with Traumatic Brain Injury (TBI). Key elements of the program include:

1) intensive, multi-disciplinary therapy,
2) repetition delivered by highly trained caregivers,
3) participation-based tasks in the home and community, and
4) integration of family and friends into therapy sessions.

Case Description: The participant is a 38 year-old female, clinically diagnosed with TBI, recruited from an inpatient rehab program. She presented with left-sided spastic hemiplegia affecting her gait, functional mobility, and participation. As a young mother of three, her primary goal for rehab was to independently ambulate in the home and community in order to care for her children. The participant received 22 hours of physical therapy and 5 hours of occupational therapy each week with reinforcement from trained caregivers and functional application in the home and community.

Outcomes: Pretreatment velocity, step length, and gait symmetry were recorded with the GAITRite™ Portable Walking System; functional mobility was measured with the Timed Up and Go (TUG), Five-time Sit to Stand (5TSST), and 10 Meter Walk Test (10MWT); and participation captured with the Satisfaction with Life Scale (SWLS) and time spent in the community. Functional mobility measurements were re-taken at 2, 7, and 10 weeks; gait reassessed at 7 and 12 weeks; and participation reexamined at 12 weeks. Significant improvements were made across all outcomes with pre and post treatment measures as follows: 5TSST from 20.80 to 9.46 seconds; TUG from 46.06 to 21.52 seconds; 10MWT from 0.22 m/s to 0.47 m/s; and SWLS from 12 (dissatisfied) to 18 (slightly dissatisfied). In addition, gait velocity and symmetry improved, and time spent in the community increased from 2 to 24 hours/week.

Discussion: The authors posit that the positive outcomes observed are produced by the unique mapping between the four aspects of the CBR intervention design and four core tenants of neuroplasticity. Improvements in gait and functional outcomes may be attributed to the intensity of the therapy and repetition provided by caregivers. Increased participation may be ascribed to the specificity of the participation-based tasks, and the salience of those tasks when performed with family and friends. Thus a CBR design emphasizing intensity, repetition, specificity, and salience may be a viable bridging of inpatient rehab and returning to home. Further research should be conducted using a case series.

Title: Intense Bout of Physical Therapy to Address Freezing of Gait and Improve Quality of Life for an Individual with Parkinson's Disease

Authors/Institutions: E. Ulanowski, J.M. Little, Bellarmine University, Louisville, Kentucky, United States| M. Danzl, Physical Therapy, Bellarmine University, Louisville, Kentucky, United States| M. Blake, Bellarmine University, Louisville, Kentucky, United States

Abstract Body:

Purpose: Freezing of gait (FOG) is one of the most debilitating symptoms in patients with Parkinson's disease (PD) and is associated with a loss of mobility associated with FOG can result in a decline in functional independence and increased caregiver burden. Traditional models of outpatient physical therapy (PT) to address these issues typically consist of 1-3 visits/week for several weeks to months, one round/year. The purpose of this special interest report is to describe the feasibility, benefits, and characteristics of an intensive bout of PT with an individual with late-stage PD to decrease episodes of FOG, decrease burden of care, and improve quality of life.

Description: A 64-year-old female diagnosed with PD (Hoehn and Yahr Stage 5) participated in an intensive round of outpatient PT (4 consecutive days, 3 hours/day). Given the 2-3 hour driving distance from home to the clinic, the patient and spouse reserved a hotel for the week. Treatment sessions were led by a board-certified neurologic specialist and 2 doctor of PT students. Each session included functional activity visualization, bed mobility, transfers, gait training, and dynamic functional mobility. Amplitude, reflection, and quality of movement were emphasized throughout the sessions to improve patient confidence. Visual, auditory, and tactile cueing were utilized as needed to promote quality movements. Weekly follow-up communication was provided to the patient and caregiver to reinforce the intense round of therapy. Pre and 3 week post-test measures were assessed (Timed Up and Go, 10 Meter Walk Test, 2 Minute Walk Test, 5 Times Sit-to-Stand, ABC Scale, FOG Questionnaire).

Summary of Use: Over the 4 days, improved movement quality, mobility, efficiency, and confidence with functional tasks were demonstrated through observational analysis, video analysis, and functional measures. FOG episodes were decreased during turns, gait, and transfers. A carryover effect was noted at the 3-week follow-up in all of these areas. Improvements were noted in all functional and subjective measures. The caregiver reported the patient had decreased reliance on her wheelchair and demonstrated increased time walking. No falls were reported. The caregiver felt confident in the patient's abilities in the home.

Importance to Members: To our knowledge, this is the first report describing the feasibility, outcomes, and characteristics of a short-term intensive bout of PT for a patient with late-stage PD. Future research is needed to longitudinally examine the outcomes of this approach. As the PD population increases so does the demand for high quality neurological care. This novel model of outpatient PT may be an optimal means of addressing issues of access to services for individuals living significant driving distances from a neurologic specialist. This report provides a springboard for therapists to consider nontraditional forms of service delivery when training patients with PD and FOG.
TITLE: For an individual with a concussion, what impact does the timing and intensity of activity have on recovery from concussion?

AUTHORS/INSTITUTIONS: J. Gross, B. Aikens, K. Kregling, C. Bryson, Physical Therapy, Franklin Pierce University, Swanzey, New Hampshire, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Optimal timing, intensity, and duration of rest and physical exertion have not been established. The purpose of this systematic review was to examine the current evidence regarding the impact of timing, intensity, and duration of exertion on recovery from concussion.

Number of Subjects: N/A

Materials/Methods: A systematic review was conducted using the following databases from inception to May 15, 2017: PubMed, CINAHL, Cochrane, Medline, and SportDiscus. The quality of the studies was assessed using the MINORS scale. The search terms used were post-concussion, rest, and exercise, with the Boolean operators applied solely consisting of “AND” between each term. Terms were entered into the databases in all possible combinations. Studies written in English and using a randomized control trial (RCT) or a cohort design only were included to ensure the most robust review of the literature. Cohort studies were included as there was found to be a small body of publications at the RCT level. Exclusion criteria were non-RCT studies and non-cohort studies, non-English articles, and non-human studies.

Results: Eight studies met the selection criteria. MINORS scores for the included studies averaged 18.8, ranging from 15 to 23. Seven of the eight included studies found that mild to moderate levels of physical activity shortly after experiencing a concussion improved recovery time faster when compared longer durations of rest time.

Conclusions: Light to moderate physical exertion may be helpful in speeding up recovery for those with post-concussion symptoms. No physical activity and high levels of physical activity were detrimental to patient recovery. Recommendations for exertional activity following concussion should be well timed and responsive to patient symptom experience. Further high quality studies should examine specific measures of type and intensity of exercise and the effect they may have on recovery.

Clinical Relevance: As the role for the physical therapist in concussion management grows, proper recommendations regarding the timing, intensity, and duration of physical exertion is paramount.
Early mobility training with a bariatric patient post stroke: Where do I start, and how do I get there?

D. Hogue, PT, Cleveland Clinic Edwin Shaw Rehabilitation Hospital, Wadsworth, Ohio, UNITED STATES

Background & Purpose: Limited research exists for bariatric rehab specifically with neurologic deficit. Most facilities do not have the capability to effectively manage this patient population with or without neurologic deficits. Patient and staff safety are a primary concern. Most therapists are hesitant to try early mobility when safety comes into question. The purpose of this case study is to demonstrate interdisciplinary management of a patient with a BMI of 49.4 who experienced a severe stroke.

Case Description: This patient was a bariatric male who experienced a left middle cerebral artery infarct with a history of severe hip osteoarthritis and previously walked with a Loftstrand crutch and cane. His initial status was total assist for all bed mobility with right hemiparesis, severe apraxia, severe aphasia, and poor midline orientation with retro and right sided pushing. Proper equipment combined with physical therapy and occupational therapy co-treats as well as body weight support using a Lite Gait allowed for early gait progression. A Liko overhead lift was utilized for early mobility into a bariatric power wheelchair. His primary therapy team utilized interdisciplinary problem solving coupled with nursing and physiatry to promote weekly progress. Weekly highlights included early use of power lift for more time upright in wheelchair, forward reaching to promote forward weight shift, use of rope ladder to facilitate rolling, unsupported sitting utilizing Hoyer to mat transfer, pull to stand in bariatric parallel bars, progression to gait training utilizing bariatric Lite Gait overground, gait in bariatric parallel bars, progressing finally to gait with bariatric wheeled walker with platform attachment for weak upper extremity.

Outcomes: This patient was able to progress from an initial FIM total score of 20 to a discharge of 50. The ultimate outcome for this inpatient rehab patient was a discharge to the home setting with home health services and not requiring additional sub-acute rehab. This patient also improved his strength in his hemiparetic right lower extremity to 4+/5 hip flexion, 4-/5 knee flexion, 4+/5 knee extension and 3-/5 dorsiflexion. He ambulated 90 feet with contact guard and minimal assistance for transfers.

Discussion: The initial presentation of this patient presented a multitude of barriers for discharge home. A progression of trunk mobility to assisted standing to eventual transfers and gait training allowed for aggressive advancement with this patient who otherwise would have been limited to a Hoyer transfer. Through use of the Liko overhead lift system, two staff could safely transfer this patient. He utilized a power wheelchair initially to promote earlier independence with hospital mobility progressing to independent with power wheelchair to minimal assistance with a manual wheelchair for short term use in home. This patient also was able to ambulate sooner through the body weight support of a Lite Gait utilized overground with assistance of two therapists and a student physical therapist.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
Background & Purpose: Conversion disorder (CD) presents a complicated, multi-factorial clinical diagnosis for physical therapists to treat effectively (Kodish 2016). CD can often present unique challenges regarding how to manage psycho-social aspects of the disorder while maximizing and returning function, and the prognosis is often poor without intervention (Lehn et al. 2015). There is growing evidence that PT is an effective treatment for CD, however the existing literature is limited regarding specific interventions in these cases (Nielsen, et al. 2014). The purpose of this case study is to demonstrate the efficacy of PT interventions with a behavioral modification approach in a patient diagnosed with CD.

Case Description: A 15-year old female presented to the clinic with paraplegia, sensory changes, pseudo-seizures, speech alterations, and cognitive impairments following NJ tube placement after a diagnosis of Superior Mesenteric Artery syndrome. Prior to the onset of her symptoms, the patient was a full-time high school student, worked as a hostess at a restaurant, and participated in gymnastics and cheerleading. At initial evaluation, the patient was dependent on a wheelchair for all mobility and required maxA to stand and transfer. She was not ambulating and could not attend her high school classes or work. Over a period of 16 weeks, the patient was treated with 28 visits of physical therapy (PT), 7 visits of occupational therapy (OT), and 2 visits of speech therapy (ST). All therapies were completed with a psycho-social approach identified in the literature for behavioral modification through positive reinforcement, a non-confrontational approach to the non-organic nature of her condition, a step-wise progression for motor milestones, and cognitive restructuring (Hubschmid et al. 2015) (Ness, 2007).

Outcomes: Outcome measures utilized during this case study included the Function in Sitting Test (FIST), Berg Balance Scale (BBS), 6-Minute Walk Test (6MWT), and the High Level Mobility Assessment (HiMat) based on the patient's current functional status. Over her initial eight visits, the patient’s FIST score improved from 30/56 to 55/56, and she tolerated walking in parallel bars. She was able to ambulate 360 ft with no AD by visit 13, which improved to 2,382 ft by discharge and she returned to running at the gym. High level mobility activities, such as skipping, hopping, and jumping were restored to near normal limits as well, as her HiMat score improved from 39/54 at visit 18 to 47/54 by discharge.

Discussion: The results of this case study support the efficacy of outpatient PT intervention with a behavioral modification approach as a potential treatment for patients presenting with CD manifesting as physical, sensory, and cognitive impairments. Normal gait, independent transfers, independence with all ADLs, standing balance, and complete return to function, including school and work activities, were all restored following 16 weeks of outpatient therapy.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: Effect of Group Exercise on Mobility for Individuals with Parkinson Disease

AUTHORS/INSTITUTIONS: T.E. Leahy, E.D. Cleveland, L. Patterson, Doctor of Physical Therapy, Lynchburg College, Lynchburg, Virginia, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Parkinson Disease (PD) is a degenerative disorder that results in a progressive decline of motor function. Intensive exercise programs have been shown to increase patient function, strength and balance. The benefit of low to moderate intensity exercise for individuals at Hoehn and Yahr (H&Y) Stage III-IV is not clear. The purpose of this case series was to examine the effect of a 6-week, student-run, bi-weekly group exercise program on the mobility of 5 individuals with PD and varying degrees of mobility dysfunction.

Case Description: Participants were recruited through a local support group. Interested parties provided physician clearance to participate in exercise, and signed informed consent approved by Lynchburg College Institutional Review Board. Five participants (mean 74.8 years) took part. Participants had a H&Y stage III or IV disease classification with disparate mobility skills. The participants will be described in terms of their years post diagnosis, mobility, activity levels, medications and pertinent history. All 5 participants underwent testing with the Movement Disorder Society Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), the Timed Up and Go (TUG), 10 meter walk test (10MWT), repetition maximum for shoulder flexion and abduction, and lacrosse ball toss distance the week prior to, and the week after, the 6 weeks of exercise. Exercise classes with mixed cardiovascular, strength, and balance training occurred 2x/ week for one hour. Each participant had 1-2 DPT students provide guarding throughout the class. Target exercise levels were established for each participant based on initial exam findings.

Outcomes: All participants improved in TUG scores and gait speed, but the change reached the level of clinical significance (MCID) for only one participant. Changes in strength varied widely between participants with none reaching the level of clinical significance. The majority of participants improved distance in the ball toss and demonstrated much improved kinematics. The overall results of the MDS-UPDRS varied between participants, with the greatest changes occurring in the motor portion for the higher functioning participants. In addition to the objective findings, qualitative improvements were seen in standing posture, gait pattern, and trunk rotation. Participants reported greatly enjoying the classes and expressed interest in continuing year round.

Discussion: The magnitude of change in the objective findings may have been limited due to the short duration of the exercise group and the variability of patient presentation. Benefits gained by the 5 participants seemed to differ based on their initial presentation. Those who had better motor function to start with demonstrated greater quantitative motor improvements, whereas those who were more involved reported larger psychosocial and qualitative benefits such as increased confidence in walking at home. A low-moderate intensity 6-week student-run program can provide benefits for community members with PD at H&Y stage III or IV.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Title: Neuroplasticity-Based Intervention Results in Reduction of Falls in a Patient with Camptocormia and Parkinson’s Disease

Authors/Institutions: J. Madsen, S.F. Voorhees, Physical Therapy, University of Jamestown, Fargo, North Dakota, United States| H. Rodne, B. Seiler, B. Simonson, University of Jamestown Physical Therapy, Fargo, North Dakota, United States

Abstract Body:

Background & Purpose: Camptocormia (CC) is a rare and severe axial postural deformity found in patients with Parkinson’s Disease (PD). CC is characterized by abnormal and excessive forward flexion of the spine exacerbated in standing and walking, and relieved when supine. Patients with CC experience restrictions in visual field, dysphagia, restricted lung capacity, falls, back pain, gait disorders and decreased quality of life. There is little research related to physical training and functional outcomes in CC. Only one study using “postural rehabilitation” for gait, balance and posture in patients with CC has been reported. While the results were significant, there was no report of the principles underlying the interventions. There is evidence for neuroplasticity-based e.g. task-specific and challenging exercises to improve balance and decrease the number of falls in patients with PD. Extrapolating from this data, we hypothesized that a 12 week postural training program structured using principles of neuroplasticity would improve sitting and standing posture, and decrease back pain and frequency of falls in a patient with CC and PD.

Case Description: Our case report describes the treatment approach used with a 65 year old man with a 5 year history of Parkinsonism (Hoehn and Yahr stage IV) and severe thoracolumbar spinal flexion. After consent, the patient participated in 60 minute intensive physical therapy sessions 2 times /week for 12 weeks. The interventions were salient, intense and task-specific. The patient was maximally challenged as each activity was performed until fatigue as judged by a visible breakdown in technique. Sessions began with impairment level interventions for fixed postural deformities of the hips and spine, followed by complex motor tasks and proprioceptive retraining. Verbal, manual and visual feedback was provided to enhance cognitive engagement.

The following primary outcomes were assessed at week 0 and week 12: visual analog scale (VAS) for low back pain, frequency of falls, and seated and standing postural analysis using the SparkMotion™ application.

Outcomes: The patient completed 24 therapy sessions without incident. At the outset of treatment, the patient was falling up to 3 times/day and after the 12 week program, he reported 2 consecutive weeks without a fall. Low back pain was reduced from a daily average of 3 to 0 and a daily maximum of 7 to 3 on the VAS. Week 1, standing trunk flexion was 62° and at week 12 it was 22°. In sitting, trunk flexion was 56° at week 1 and the patient was unable to sit upright to utilize the backrest on a chair. At week 12, trunk flexion in sitting was 29° without back support and just 3° with back support.

Discussion: Our neuroplasticity-based training program suggests that improvement in posture and reduction of falls and back pain can be achieved in patients with CC and PD. While a case study, our results do raise a new treatment option for a patient with CC and PD.


Purpose: The primary purpose of this presentation is to define the impairments of body structure and function and potential activity limitations characteristic of three specific types of Fragile X-associated Disorders (FXD). The secondary purpose is to present physical therapy issues related to impairments of persons aging with the FMR1 gene.

Description: Fragile X syndrome (FXS) is the most common form of inheritable intellectual disability and is also identified as the most common genetic cause of autism spectrum disorders. FXS is found in all parts of the world and among every ethnic group. The frequency of occurrence is 1:3600 in males and 1:4000 in females. FXS is an X-linked disorder of the FMR1 gene. FXS is one of three impairments that, as a group, are labeled FXD and are related to either premutations or full expansion of the FMR1 gene. The FXD group also includes fragile X-associated primary ovarian failure syndrome (FXPOI), and fragile X-associated tremor/ataxia syndrome (FXTAS). Fragile X premutations occur 1:151 in females and 1:468 in males. Together, these three health conditions appear in children to aging adults. This single gene disorder causes intergenerational problems which could simultaneously impact several generations in one family.

Summary of Use: While FXS is typically known as a pediatric disorder, the health conditions of adults who carry the FMR1 gene are not as well defined. Of significance is that there are a broad range of disabling impairments associated with FXD that can arise over the lifespan. The three distinct disorders related to variable gene expression of multiple family members are not always identified or well understood by physical therapists who, nevertheless, may treat such persons without appreciating the underlying health condition. While there is limited published information available that addresses the topic of aging with the FMR1 gene, this review includes 12 key articles that address this aging problem. The articles represent a summary of the work of a number of participants of FXD research teams that have identified FXD aging issues.

Importance to Members: Early recognition and attention to the neurodegenerative impairments associated with Fragile X-associated Disorders may help define interventions that can support prevention as well as the preservation of independent function and quality of life over the life span. In order for therapists to achieve that goal, there is a need to distribute current information about three distinct health conditions that are related to the single gene disorder of the FMR1 gene.
TITLE: RHYTHMIC AUDITORY STIMULATION AND GAIT TRAINING IN TRAUMATIC BRAIN INJURY: A Feasibility Study

AUTHORS/INSTITUTIONS: K. Hays, Physical Therapy, Craig Hospital, CO, Colorado, UNITED STATES|S. Thompson, Speech Therapy, Craig Hospital, Englewood, Colorado, UNITED STATES|A. Weintraub, CNS Medical Group, Craig Hospital, Englewood, Colorado, UNITED STATES|R.G. Kowalski, J.M. Ketchum, Research, Craig Hospital, Englewood, Colorado, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: To investigate the feasibility of using Rhythmic Auditory Stimulation (RAS) for gait training with individuals who have chronic traumatic brain injury (TBI).

Number of Subjects: 9 community dwelling individuals 1-20 years post TBI, aged 18-65, Glasgow Coma Score <13, Functional Gait Assessment (FGA) score <22, no formal physical therapy in the last 30 days. Participants were able to ambulate at least 30 minutes with assistive devices, braces and rest breaks as needed, had a deviation in spatiotemporal aspects of gait, and were hemiparetic and/or ataxic.

Materials/Methods: This was a cohort pilot study. Following informed consent, participants completed assessment at baseline, pre-test 2 weeks after the baseline, post-test immediately following the 2 week intervention, and follow up 1 week after the final intervention. Outcomes included: 10 meter walk test, GAITRite gait analysis, manual muscle testing, the Modified Ashworth Scale, the Functional Gait Assessment (FGA), and the Physical Activity Enjoyment Scale (PACES). Participants completed 9-10 treatment sessions in a 2 week period. The daily treatment protocol included: a 2 minute warm-up walk; listening to a musical stimulus matched to cadence (beats/minute) for 5 minutes; walking with the musical stimulus (RAS) at their baseline cadence for 13 minutes; and walking with RAS at 5% higher cadence for 10 minutes. RAS was delivered in the form of preferred music with a rhythmic click. Music was chosen and altered by a board certified music therapist. Participants walked with a physical therapist. The distance walked and the time walked by each participant was tracked daily. A Diary of Adverse Events was completed daily during intervention to determine safety.

Results: RAS is a safe and feasible intervention for individuals with a TBI that yields improvements in gait. There were no adverse events reported during the treatment, and overall participants reported enjoying the intervention (mean PACES score 63.6). In addition, participants showed significant improvements in their gait speed (mean improvement of 0.12 m/s, p = 0.0275), distance walked during the intervention (mean improvement of 1412 feet, p = 0.0014), cadence during the intervention (mean increase of 10.4 steps/minute, p = 0.0040), and FGA score (mean improvement of 2.7 points, p = 0.0027). In addition, all participants had FGA scores less than 22, indicating an increased risk of falls, prior to the intervention. At post-treatment testing, 5 of the participants (56%) had scores of 22 or higher.

Conclusions: RAS is a feasible, safe, and enjoyable treatment for these individuals, but more research is needed in this population.

Clinical Relevance: Physical therapists in the neurological rehabilitation field spend a significant amount of time working on gait training rehabilitation. The addition of RAS appears to be a useful therapeutic intervention to assist individuals with gait abnormalities following TBI.
Background & Purpose: Several studies have proposed a correlation between vestibular dysfunction and anxiety disorders, such as agoraphobia. Compensatory overuse of the visual system may cause anxiety secondary to disorientation in the absence of visual cues. Studies on virtual reality (VR) training in vestibular therapy (VT) have primarily focused on treatment for visual vertigo or vestibular hypofunction, but no known studies have explored this treatment for patients with agoraphobia in a VT setting. The purpose of this case study is to describe the use of VR training in a patient suffering from agoraphobia.

Case Description: The patient began VT to address chronic imbalance and disorientation provoked by open spaces, prompting him to use a cane in these environments. Vestibular evaluation findings suggested compensated left vestibular hypofunction and over-reliance on his visual system. He previously received conventional VT without successful reduction in his symptoms. As a result, VR training was initiated using a cardboard headset. Videos included relevant settings – high ceiling rooms, stadiums, galleries, wide city streets – and were used if the patient reported replication of his primary symptom. VR exercises began with the patient seated and head stationary, and then progressed to standing on a firm surface, compliant surface, walking, and walking while turning his head. He was instructed to watch a VR video at home 5 times a day for 1-2 minutes each until no longer symptomatic, at which point another VR scenario would be trialed.

Outcomes: Outcome measures included the Visual Vertigo Analogue Scale (VVA), the Dizziness Handicap Inventory (DHI) and the Activities-Specific Balance Confidence Scale (ABC scale) as well as the patient’s subjective report. His DHI score increased from 30/100 to 32/100; however his ABC scale score improved from 73% to 80%. He reported improved symptoms with the following components measured on the VVA: walking through a supermarket aisle (improved by 25%), being a passenger in a car (improved by 40%), being under fluorescent lights (improved by 47%), watching traffic at a busy intersection (improved by 38%), walking through a shopping mall (improved by 18%). He also discontinued his use of an assistive device outside therapy in many formerly provoking scenarios.

Discussion: The patient reported improved function and reduced anxiety following VR training. VR exposes a patient to visually conflicting information in relevant settings, which may address the suspected underlying etiology of high visual reliance in agoraphobic patients. It also provides a clinician access to situations that may otherwise be impossible to replicate in a clinical setting, while controlling duration of exposure and somatosensory input. Finally, it offers a patient a sense of self-control to foster compliance. Future research is warranted to explore the efficacy of VR training in patients with agoraphobia.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: The Post Stroke Upper Limb Recovery Effort Survey (IMPETUS)


ABSTRACT BODY:

Purpose/Hypothesis: A majority of stroke survivors report limited arm and hand function. The purpose of this study was to examine the factors that influence how these individuals view their arm and hand function, their perceived barriers to recovery, and their willingness to use a device for arm and hand function. We investigated the following questions: 1) Is there a difference between perceived and desired levels of hand function post stroke? 2) Is there a difference between actual and desired hand function? 3) Is there a difference between impairment level barriers and social barriers to the recovery of arm/hand function?

Number of Subjects: 852 individuals with chronic (>1 year post) stroke were invited to participate. 94 individuals responded; 27 subjects completed the survey by phone and 67 completed it electronically

Materials/Methods: A 64-item electronic survey was developed which incorporated items from the Hand Function Subscale and the Arm Function Subscale of the Stroke Impact Scale (SIS). The survey focus included: 1) life before stroke, 2) impact of stroke on daily life, 3) arm and hand function after stroke, 4) goals for arm and hand function, 5) barriers to the recovery of arm and hand function, and 6) willingness in using a device for arm and hand function. Items were scored using a 1-5 Likert scale. A 0-100 scale was used for recovery items. Face validity was established by 13 experienced clinicians and 7 individuals with stroke. The survey was administered via Research Electronic Data Capture. Participants were recruited from the Clinical Neuroscience Research Registry. Data was analyzed using Microsoft Excel and SPSS.

Results: Perceived level of hand function recovery (35±31, mean±sd) was significantly lower than the desired level (64±31, mean±sd) (p<0.0001). The actual level of hand function (27±23, mean±sd) was significantly lower than desired level (53±21 mean±sd), based on SIS subscores (p<0.0001). Participants reported that impairment level barriers (weakness, spasticity, and loss of independent joint control) hindered their recovery significantly more than social barriers (access to physical therapy, family support, transportation, etc.) (p<0.0001).

Conclusions: There was a statistically significant gap between participants’ perceived level of hand function and their desired level, demonstrated by both the amount of recovery scores and SIS hand function subscores. Participants reported the main barriers for recovery of hand function were weakness, spasticity, and being able to use the arm and hand during daily activities.

Clinical Relevance: Following stroke, individuals’ expectations of hand function are significantly higher than actual recovery. These individuals perceive functional impairments, rather than social factors, as the largest barriers to recovery.
TITLE: A Comparison of Head Velocity Between the First Movement of the Epley Maneuver and the Long Arc Movement of the Semont Maneuver

AUTHORS/INSTITUTIONS: J. Nelson, B.N. Buske, E. Gallagher, M. Johnson, A.J. Strafelda, B. Longacre, Physical Therapy, College of St. Scholastica, Duluth, Minnesota, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Canalith repositioning maneuvers, like the Epley and Semont, have consistently been reported as efficacious treatments for patients with benign paroxysmal positional vertigo (BPPV). Both maneuvers orient and then move the head to expose the pathological canal to gravity, optimizing its effect on canalith movement. The Epley maneuver is the most common treatment method, while the Semont maneuver is used in persistent cases of BPPV. Adjectives used to describe the execution of these maneuvers include “brisk,” “rapid,” or “quick.” However, there is no literature that quantifies the velocity at which to perform the maneuvers, nor if a difference in head velocity exists between the two maneuvers. The purpose of this study was to describe the range of head velocities that occur during the maneuvers and to compare peak head velocity during the first positional change of the Epley maneuver to the peak velocity of the long arc positional change of the Semont maneuver. The maneuvers were performed on two mock patients of different heights by each of the twenty-five student subjects.

Number of Subjects: Twenty-five DPT student subjects performed the maneuvers on two mock patients.

Materials/Methods: An 8-camera motion capture system and reflective markers were used to track head position in space. Data was processed with Visual3D and analyzed with a repeated measures ANOVA. Two coordinate systems were developed to define the laboratory space. Markers on the head allowed for movement to be defined relative to the laboratory coordinate system. Head velocity occurred within the sagittal plane defined by plinth position. Each student subject was instructed to perform the two maneuvers on both mock patients as data was collected.

Results: Results indicated a significant difference (p = 0.004) between average peak velocities of the two maneuvers. Mean peak head velocity of the Epley maneuver was 200 deg/sec, +/- 34 deg/sec. Mean velocity of the Semont maneuver was 177 deg/sec, +/- 36 deg/sec. No significant difference in average peak velocities (p= 0.098) were found based on mock patient stature.

Conclusions: Results show the Epley was performed at a greater average peak velocity than the Semont. Overall, the peak velocities of each maneuver showed large variability, suggesting there was not a consistent speed at which the maneuvers were executed.

Clinical Relevance: When repositioning maneuvers are taught to students, it is implied that the speed of the execution of the maneuvers is important. It is also implied that the Semont maneuver is the more aggressive maneuver to perform. Results of this study indicate that the peak head velocities of the Epley are consistently performed at a higher velocity when compared to the long arc movement of the Semont maneuver in newly trained clinicians.
Purpose/Hypothesis: There is an increased awareness as to the importance of performing ocular-motor screening test in people post-concussion. Clinically these screening tests have been incorporated in assessment of vestibular patients, as often these clients share visual symptoms that are similar to those observed in people with post-concussion. This retrospective chart review aims to investigate the conversion divergence screening test results in clients with vestibulopathy.

Number of Subjects: The charts of 61 clients admitted to an outpatient vestibular program that had a complete convergence divergence screening test were reviewed. All clients had been referred by an otologist or neurologist.

Materials/Methods: The Break Point (BP) and clear point (CP) were each measured 3 times. BP is defined as the distance where a small object (end cap of a disposable pen) is seen as double as it converges toward the tip of the client’s nose. CP represents the distance where the object returns to being visualized as single as it moves away from the BP. Additionally convergence and divergence saccades were assessed using the Convergence divergence test (CDT) which measures the time taken to complete 10 cycles of alternately looking at a target 10 cm and another 3 m anterior to the subject’s nose. The clients were divided into two groups, using norms available in the literature (Mucha et al. 2014): An affected BP group that included subjects with BP average score of the 3 trials >5cm and a normal BP group whose average 3 trials BP score was ≤5cm. Independent t-tests were used to investigate the effect of group on mean CP and CDT score.

Results: The majority (67.2%) of the clients were female and the mean age was 65.6±13.8 years (mean±standard deviation). At the time of initial assessment, mean scores on the Dizziness Handicap Inventory (DHI) and Visual Vertigo Analogue Scale (VVAS) were 40.5±22.8 and 21.4±23.6, respectively. Mean (±1SD) scores of BP, CP and CDT were 7.4±3.8 cm, 15.1±6.7 cm and 13.9±3.8 s, respectively. The independent t-test revealed a significant difference (p<0.0001) between the CP scores for the normal (9.1±3.3) and abnormal group (17.3±6.3). No statistical difference (independent t-test) was found between the CDT score of two BP groups. Lastly low Pearson coefficient correlation was identified between VVAS or DHI and all three conversion divergence test scores.

Conclusions: Preliminary review indicates that conversion diversion tests are often affected in vestibulopathic subjects. Further research studies are needed to investigate in greater details the relationship between specific pathologies/vestibular symptoms with the specific conversion divergence tests and the impact of abnormal ocular motor function on vestibular rehabilitation outcome.

Clinical Relevance: A clinical relevance of this study is that it found that convergence and divergence screening tests are often affected in people with vestibulopathy, and therefore it appears it should be screened.
Purpose/Hypothesis: Evidence in animal models suggests that the presence of beta-amyloid, a hallmark pathology of Alzheimer’s disease, may interfere with endothelial-dependent response of the cerebral arteries and can impair cerebrovascular function. If impaired cerebrovascular function is one mechanism by which beta-amyloid accumulation causes neurodegeneration, replication in humans would have important implications regarding brain health. We hypothesized that: 1) cerebrovascular reserve capacity (CVRC) was lower in participants with elevated beta-amyloid when compared to participants who are characterized as non-elevated and 2) greater amyloid load would be associated with lower CVRC.

Materials/Methods: The Alzheimer’s Disease Center characterized beta-amyloid florbetapir PET scans and performed cognitive testing to ensure all older adults were cognitively normal. We characterized middle cerebral artery blood flow velocity of each participant using transcranial Doppler ultrasound at rest and during moderate intensity exercise using a recumbent stepper. We calculated the CVRC as the difference in blood flow velocity from rest to exercise.

Results: Sixty-one participants were included for data analysis. No between group differences for age, sex, cardiac risk. Baseline values for CVRC were not different between groups (p>0.10). We found that individuals with elevated beta-amyloid had a 36% lower CVRC (n=16:3.9 cm/s) than non-elevated individuals (n = 45: 6.6 cm/s, p = 0.04). Further, lower CVRC was linearly associated with greater beta-amyloid load across all participants (CVRC; b = -9.3. p = 0.03).

Conclusions: We are the first to characterize CVRC using an exercise challenge in people with and without elevated beta-amyloid. These results extend the growing literature in humans that cerebrovascular dysfunction and beta-amyloid accumulation are closely linked.

Clinical Relevance: Physical therapists advocate for their patients to participate in healthy lifestyles and exercise. We should understand vascular risk factors that may affect brain health and the role exercise has for prevention and treatment of Alzheimer’s disease, vascular dementia and stroke.
Initial Construct Validity of the 3-Meter Backward Walk Test in Individuals With Chronic Stroke

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ABSTRACT

Purpose/Hypothesis: Post-stroke gait rehabilitation emphasizes the recovery of forward walking and assessment of forward walking speed is becoming standard in assessment of recovery. However, gait adaptations such as backward walking (BW) are also critical for safe navigation in the home and community. Recent evidence suggests BW speed may be a useful predictor of fall risk and rehabilitation that incorporates BW may lead to improvements in forward walking function. Current assessments of BW speed use costly instrumented walkways or motion capture systems not readily available to most physical therapy clinics. A standardized clinically-accessible measurement of BW speed for adults post-stroke is needed. The purpose of this study is to establish preliminary data on the construct validity of the 3-Meter Backward Walk Test (3MBWT) in individuals post-stroke.

Number of Subjects: Nine ambulatory individuals with first-time stroke (6 male; 5 left hemispheric stroke; 59.8 ± 5.7 years old; 12.7 ± 4.6 months post-stroke) and lower extremity (LE) paresis (mean LE Fugl-Meyer Motor Score 26.4 ± 4.1) participated.

Materials/Methods: Participants were enrolled in a gait rehabilitation randomized controlled trial. Comfortable BW speed was measured with both a 12-camera motion capture system and the 3MBWT, a clinically-adapted assessment. Assistive and orthotic devices were used only if necessary and were consistent between the two measurements. For motion capture, reflective markers were placed on each heel for identifying gait events. Walking speed was calculated as the stride length divided by stride time. The 3MBWT was part of a clinical assessment battery, conducted separately from the motion capture assessment. Following demonstration of the 3MBWT, participants were instructed to walk backwards at their comfortable pace a total of 5 meters. A therapist walked alongside the participant to ensure safety. Walking speed was calculated by dividing 3 meters by the time taken to walk the middle 3 meters, marked on the floor. Two trials of each assessment were recorded and averaged. Association between the two BW assessment methods was examined using Pearson's correlation coefficient.

Results: The average walking speeds calculated from the motion capture and the 3MBWT were 0.30 ± 0.14 m/s and 0.28 ± 0.12 m/w, respectively. There was a strong, positive correlation between the two methods of backward walking speed assessment (r = 0.89; p = 0.001).

Conclusions: The strong positive correlation between the gait speeds from the motion capture and the 3MBWT supports the construct validity of this new assessment.

Clinical Relevance: By utilizing a clinical outcome measure to capture backward walking speed, clinicians may improve their ability in identifying individuals post-stroke who may be at a risk of falling. This simple, inexpensive clinical assessment to measure backward walking speed will be an important addition to the assessment toolbox in the rehabilitation of individuals post-stroke.
TITLE: Improved Posttest Scores in Neurologic Content Areas following an NCS Online Review Course

AUTHORS/INSTITUTIONS: J.B. Stephenson, School of Physical Therapy & Rehabilitation Sciences, University of South Florida, Tampa, Florida, UNITED STATES|J. Tucker, M.C. Beato, Doctor of Physical Therapy Program, University of Central Florida, Orlando, Florida, UNITED STATES|M.E. Parker, Department of Physical Therapy, Texas State University, San Marcos, Texas, UNITED STATES|S.M. Trojanowski, Physical Therapy Department, Sinai Grace Hospital Inpatient Rehabilitation Unit, Royal Oak, Michigan, UNITED STATES|A.N. Dennis, Physical Therapy Department, University of Washington Medical Center, Seattle, Washington, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The Neurologic Clinical Specialist (NCS) Online Review and Discussion Forum was developed by the NCS Committee of the Academy of Neurologic Physical Therapy (ANPT) to support individuals preparing for the ABPTS Neurologic Physical Therapy Board Examination. The online review course provided test candidates from different geographical regions the opportunity to create online study groups, share resources and discuss strategies to prepare for the NCS examination. The course included lectures from seven neurologic content areas, taught by faculty and clinical experts, and identified by previous test takers as requiring additional resources to adequately prepare for the exam. The use of online technology in physical therapy is effective in increasing knowledge of students and professionals participating in discussion boards and content specific websites. Use of web based, asynchronous technology can be effective in improving learning experiences and outcomes in physical therapy and other health professions. The NCS online review course is the first free online preparation course commissioned by a section of the APTA to support individuals taking a board specialty examination. We hypothesized that participation in the ANPT NCS Online Review Course would lead to improved posttest scores compared with pretest scores in several competency areas in Neurologic Physical Therapy.

Number of Subjects: 389 physical therapists

Materials/Methods: Subjects participated in an online review course which covered modules in seven competency areas of neurologic physical therapy including: outcome measures, evidenced based practice, vestibular rehabilitation, motor control and motor learning, professional roles, orthotics and pediatric neurology. Subjects took a multiple choice pretest and posttest before and after participation in each module. Pre- and posttest scores were averaged for each competency area. Paired samples t-tests were applied to determine whether there was a significant difference in mean posttest scores compared with mean pretest scores in each competency area following completion of course modules. Effect sizes were also calculated to determine the magnitude of the mean differences.

Results: Following participation in the NCS online review course, subjects’ average test scores increased across seven competency areas. Paired samples t-tests demonstrated a significant improvement on posttests compared with pretests in all seven areas (p<.001). Moderate to large effect sizes were found for all competency areas (Cohen’s d ranged from 0.453 to 1.358).

Conclusions: Physical therapists preparing for the NCS examination may benefit from an online review course which presents didactic information and fosters discussion around case based questions. The results of this study may drive future development of this online course.

Clinical Relevance: Providing practical and cost effective online courses to help physical therapists prepare for board examination may encourage more therapists to pursue neurologic specialist certification in the future.
TITLE: Differentiation of Discharge Destination in a Stroke Population Using the AM-PAC "6-Clicks" Basic Mobility Short Forms Post Acute Hospitalization


ABSTRACT BODY:

Purpose/Hypothesis: Multiple studies identify mobility limitations as a predictor for further rehabilitation services following acute hospitalization for stroke. (1,2,3,4) In an acute hospital setting The AM-PAC "6-Clicks" Basic Mobility Short Forms (6 Clicks) is clinically valid in identifying the need for further rehabilitation services and predicts discharge destination to home or rehabilitation setting in a mixed population. (5,6) There is a need to determine if the 6 Clicks cut-off scores for home discharge can be used in the stroke population. In addition, the discharge destination for further rehabilitation services to either acute in-patient rehabilitation (AIR) or subacute rehabilitation (SAR) early in the patient’s hospital stay needs to be distinguished in this population. The purpose of this study was to retrospectively evaluate the utility of the 6-Clicks in distinguishing 3 discharge destinations (home, AIR, SAR) for individuals admitted to a stroke service.

Number of Subjects: 187 adults

Materials/Methods: Patient records from April to June for 2015 & 2016 were retrospectively analyzed for all adults admitted to the Stroke Service at New York Presbyterian Hospital (NYPH). Demographic data (age, length of stay (LOS)), scaled scores for 6 Clicks initial visit, and discharge destination (home, AIR, SAR) were extracted. Demographic data for the two 3-month periods were collapsed as no statistical differences were found. Means and standard deviations were computed based on discharge destination. One way ANOVA (discharge destination) was used to determine if significant differences (p≤.05) existed for demographic or 6 Clicks data. Post-hoc analysis was performed using a least squares method.

Results: Mean age was younger in people discharged home (67.39 ± 16.93, p=0.008) and AIR (65.02 ±12.70, p=0.001) compared with SAR (75.40 ± 11.70). LOS was shorter for the home group (4.95 ± 5.63, p<0.004) compared to the other 2 groups (AIR: 10.56 ± 10.20; SAR: 9.47 ± 7.01). Initial scaled score 6 Clicks data were significantly different between the 3 discharge destination groups (F =51.43, p<0.0001), with scores for home (47.37 ± 8.55) higher than AIR (36.97 ±5.66) which were higher than SAR (33.4 ± 7.39).

Conclusions: Individuals that went home had a 6 Clicks score that was in agreement with the published research for a mixed population. (6) More importantly, our data demonstrates that there exists a further distinction in 6 Clicks initial scaled scores for discharge to AIR and SAR. More research on a larger data set is needed to identify definitive cutoff values for each.

Clinical Relevance: Initial 6 Clicks mobility scores may be a useful in identifying not only the need for further rehabilitation services but also the type of rehabilitation service (home, AIR, SAR) for individuals admitted to a stroke unit.
TITLE: Relationship of upper extremity range of motion with daily activities and clinical measures in persons with multiple sclerosis

AUTHORS/INSTITUTIONS: J. Ruiz, K.M. Olson, H. Hawks, A.C. Lo, Mandell MS Center, Mount Sinai Rehabilitation Hospital, a member of Trinity Health New England, Hartford, Connecticut, UNITED STATES| E. Triche, Brown University, Providence, Rhode Island, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: To examine the relationship of upper extremity (UE) AROM with both difficulty and assistance with daily activities as well as clinical measures among pwMS.

Number of Subjects: 267

Materials/Methods: This was a non-experimental, prospective observational study of pwMS. Four hundred pwMS were randomly selected from a community-based MS center and mailed recruitment letters of which 267 participated. The following were collected: active range of motion (AROM): shoulder flexion (SF), abduction (ABD) & external rotation (ER); elbow extension (EE) and wrist flexion (WF); self-perceived difficulty and level of assistance needed with the following daily activities: walking outside, stairs, rising from a chair, putting on pants, washing whole body, putting on shirt, vacuuming, performing job and driving a car (questions extracted from functional status index (FSI)); all questions were analyzed for two sub-categories: difficulty performing and assistance needed during each task. Clinical measures included: timed up and go (TUG); timed 25ftwalk (T25ftw); nine whole peg test (9HPT), box and block (BBT), disability level (patient determined disability status [PDDS]) and UE coordination (FTN). Data were analyzed using spearman's rank-order correlations; UE AROM, 9WPT and BBT were each separated into dominant (D) and non-dominant (ND) and the alpha level was set at <0.05.

Results: All AROM movements examined demonstrated significant relationships (p<0.05) with assistance needed during all tasks (r = -0.131 - -0.428) except for assistance putting on pants and shirt, both of which were not associated with D WF (r = -0.113, -0.094, respectively). All AROM movements were significantly associated with difficulty while putting on pants and washing whole body (r = -0.152 - -0.339). All AROM movements except D EE, were significantly associated with difficulty walking outside, climbing stairs, rising from a chair, putting on a shirt and vacuuming (r = -0.125 - -0.312). Only D ER was significantly correlated with difficulty while performing job (r = -0.238), while ND shoulder ABD and WF were the only AROM movements significantly correlated with difficulty driving (r = -0.154 - -0.157). All AROM movements were significantly associated with the following clinical tests: TUG and T25ftw (r = -0.135 - -0.400), and NHPT (r = -0.158 - -0.357), FTN (r = 0.156 – 0.344) and BBT on the respective sides (r = 0.137 -0.359). All AROM movements except for EE (D) and ER (D and ND) were significantly associated with grip strength and endurance (r = 0.148 – 0.199).

Conclusions: AROM of both the D and ND UE demonstrated significant relationships with daily tasks. At least moderate associations with observed for SF and ABD (D and ND) with the amount of assistance needed as well as difficulty completing functional tasks.

Clinical Relevance: A paucity of literature exists on UE AROM in pwMS. Data on range of motion related to completion of daily activities can aid in the clinical evaluation of pwMS as well as improving education of other clinicians on when to refer pwMS to physical therapy.
Using data from the Activity Measure for Post-Acute Care (AM-PAC) versus the Morse Fall Scale (MFS) to predict patients at risk for falls

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Purpose/Hypothesis: The MFS is widely used in acute care hospitals to assess patients’ likelihood of falling. Using the MFS, a high percentage (81%) of patients are moderate to high fall risk on our inpatient rehabilitation unit. It has been difficult to focus fall reduction strategies since so many patients are classified as moderate to high fall risks. The AM-PAC is used daily on our unit to measure patients’ activity, cognition and mobility levels. After reviewing AM-PAC data of patients who had a fall on our unit, a trend was noted. It appeared that patients with a cognitive AM-PAC score of less than 15 or an AM-PAC mobility score between 10-18 captured the patients that experienced a fall. This study was designed to investigate if the AM-PAC could help our inpatient rehabilitation unit more selectively identify patients who are at risk for falls. We investigated two hypotheses: (1) a cognitive AM-PAC score of less than 15 or an AM-PAC mobility score between 10-18 will capture the patients who fall during their inpatient rehabilitation stay and (2) the AM-PAC is more selective than the Morse in identifying patients who are at risk for falls.

Number of Subjects: 28 patients that had a fall during the collection period on our inpatient rehabilitation unit

Materials/Methods: The cognitive AM-PAC, mobility AM-PAC and MFS data were collected daily on all patients to calculate the percentage of patients each test would identify as at risk for falls. They were also collected on the day a patient had a fall for analysis on whether they were identified at risk for falls. During the data collection period, 28 patients fell on the inpatient rehabilitation unit.

Results: Of patients who fell, 26 of 28 patients (93%) had a cognitive AM-PAC score of less than 15 or AM-PAC mobility score between 10-18. 447 of 790 (57%) of all AM-PAC scores fell in the parameter of a cognitive AM-PAC score of less than 15 or an AM-PAC mobility score between 10-18. Of patients who fell, 27 of 28 (96%) had a MFS that placed them in the moderate to high fall risk category. 302 of 374 (81%) of all MFS scores were determined to be moderate to high fall risk.

Conclusions: These findings are consistent with the hypotheses that: (1) a cognitive AM-PAC score of less than 15 or an AM-PAC mobility score between 10-18 does identify the patients who fall (93% for AM-PAC versus 96% for the MFS) and (2) the AM-PAC would be more selective than the MFS in the patients it identifies at risk for falling (54% for the AM-PAC versus 81% for the MFS).

Clinical Relevance: The MFS and AM-PAC were very similar (96% vs 93%) in labeling patients at risk for a fall that had a fall while on our inpatient rehabilitation unit. The AM-PAC was more selective (54% vs 81%) at labeling an individual a fall risk. This allows our inpatient rehabilitation facility to focus resources towards those at a greater risk of falling. With our average daily census at 36, the AM-PAC allows us to focus on roughly 19 patients at most risk for falls compared to roughly 29 patients on the MFS.
Title: Examination of the relationship of the Timed Up and Go Test to functional home and community tasks

Authors/Institutions: J. Ruiz, Mandell MS Center, Mount Sinai Rehabilitation Hospital, Hartford, Connecticut, United States; K.M. Olson, H. Hawks, A.C. Lo, Mandell MS Center, Mount Sinai Rehabilitation Hospital, a member of Trinity Health New England, Hartford, Connecticut, United States; E. Triche, Brown University, Providence, Rhode Island, United States

Abstract Body:

Purpose/Hypothesis: The purpose of this study was to examine if the Timed up and Go Test is associated with daily functional tasks in ambulatory persons with Multiple Sclerosis (pwMS). Hypothesis 1) the timed up and go test will have at least a moderate correlation with self-perceived difficulty with daily performance measures including stairs, rising from a chair, performing job, driving, and visiting with family/friends.

Number of Subjects: 251

Materials/Methods: This non-experimental, prospective observational study of a random sample of pwMS recruited 251 pwMS who were eligible and willing to participate and completed the following measures: timed up and go (TUG), timed 25 foot walk (T25FW), functional status index questionnaire of which the following tasks were examined for this study: walking outside, climbing up stairs, and rising from a chair, performing your job, driving a car, attending meetings, and visiting family and friends. Tasks were analyzed as two sub-categories: assistance needed and difficulty performing task. Patient demographics were also collected. Data were analyzed using spearman's rank-order correlations and the alpha level was set at <0.01.

Results: The TUG demonstrated stronger associations than T25FW with functional tasks, however all correlations examined were significant. The association between assistance needed compared to the TUG and T25FW, respectively, include: walking outside (r=0.713, r=0.656), climbing up stairs (r=0.633, r=0.595), and rising from a chair (r=.510, r=0.386) performing your job (r=0.489, r=0.426), driving a car (r=0.523, r=0.408), attending meetings (r=0.377, r=0.307), and visiting family and friends (r=0.582, r=0.540). The association among self-perceived difficulty with functional tasks with the TUG and T25FW, respectively, include: walking outside (r=0.543, r=0.481), climbing up stairs (r=0.566, r=0.507), and rising from a chair (r=.347, r=0.310) performing your job (r=0.506, r=0.471), driving a car (r=0.478, r=0.392), attending meetings (r=0.304, r=0.260), and visiting family and friends (r=0.386, r=0.353).

Conclusions: The TUG demonstrated a strong, significant association with both self-perceived need for assistance as well as difficulty with the following performance measures: walking outside, climbing up stairs, rising from a chair, driving a car, and visiting with family and friends. Therefore, slower or worse TUG times are associated with both decreased independence and increased difficulty with performance measures.

Clinical Relevance: Walking and stair climbing are critically important to maintaining community-level functioning and independence. The timed 25ft walk as well as the timed up and Go Test are often associated with gait assessment in persons with multiple sclerosis (pwMS) and recommended for use with this population. However, more literature exists on the relationship of the 25ft walk than the TUG in pwMS. Increased understanding of the TUG’s relationship to such tasks may assist in setting goals, determination of clinical assessments as well as development of individualized care plans.
TITLE: The Impact of Different Forms of Dance Therapy on Functional Mobility, Cognition and Quality of Life in Individuals with Parkinson’s Disease

AUTHORS/INSTITUTIONS: H. Fritz, A. Croley, M.M. Mancuso, A. Lieberman, G.M. Mucaro, Physical Therapy, Misericordia University, Dallas, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this systematic review was to investigate the effect of different modes of dance on quality of life (QOL), mobility and cognition in patients with Parkinson’s Disease (PD).

Number of Subjects: N/A

Materials/Methods: Two searches of literature were performed in February and September of 2016 which yielded a total of 83 articles. Search terms included Parkinson* and Danc* and Therap* as well as Parkinson’s disease and dance. Inclusion criteria: a population of 60 years or older, years between 2006-2016, peer reviewed, and publication type including RCT. Exclusion criteria: duplicates, not accessible in the English language, articles that discussed depression, anxiety, patients that were non-mobile, editorials or pictorials, and magazines. The articles were rated by utilizing the PEDro scale and the Sackett level of evidence scale assuring high quality evidence.

Results: A total of 16 articles were included in this systematic review. The articles included were a PEDro score of 5/10 or higher, twelve articles were Sackett level two and four articles were Sackett level 3. The sample sizes ranged from ten to seventy-five subjects. Different styles of dance included the Argentine tango, Irish-step, improvisation, tango, modern dance, waltz, fox trot and general dance. Dance was compared to a variety of different methods of treatment such as traditional exercise, education, tai chi, partner and non-partner dance as well as no intervention. Researchers chose to perform the experiment while participants were either on medication or off medication. The time that the individuals took their medication may have potentially been inconsistent with timing of outcome measure administration. The severity of Parkinson’s was considered. Numerous outcome measures were utilized for mobility (MDS-UPRDS-3, 6 MWT, TUG, BBS, FOG, FAB, GAITRite, MiniBESTTest, PIGD, 9HPT), cognition (MoCA, FAB cog), MRT, and quality of life (BDI, HRQol, ABC).

Conclusions: Evidence suggests dance therapy has significant effects on quality of life, mobility and cognition in those with Parkinson’s Disease. Different styles of dance offer various benefits allowing for gains in functional mobility. Understanding the background of the different styles of dance will help therapists gain knowledge and insight on this alternate form of therapy. Psychosocial advantages had a positive effect on functional mobility in patients with Parkinson’s Disease. Future research should focus on the transference of ADL’s to demonstrate functional gains from the use of dance therapy over a lengthened period of time.

Clinical Relevance: Dance therapy can be an essential tool utilized in a plan of care to improve balance, mobility, cognition and QOL. Dance therapy is an intervention allowing participants to continue for a long period of time. Dance can be seen as an asset to the physical therapy field, it is important to note that referral out is more beneficial to the patients due to the expertise of the dance instructors in the field of dance therapy.

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Purpose/Hypothesis: This study aimed to utilize Hierarchical Linear Modeling (HLM) to describe the variation in patient outcomes and predictors across Traumatic Brain Injury Model Systems (TBIMS) rehabilitation centers, and identify specific patient-level demographic, severity, and clinical factors associated with significant differences in patient outcomes (Functional Independence Measure (FIM) and Disability Rating Scale (DRS)) across TBIMS centers.

Number of Subjects: 1974

Materials/Methods: A total of 1974 individuals 16 years or older with moderate to severe traumatic brain injury (TBI) who received inpatient rehab were included in a multi-center observational cohort study using HLM to analyze prospectively collected data. The main outcomes assessed were the Functional Independence Measure (FIM) and Disability Rating Scale (DRS) total scores at discharge and 1 year post-TBI. Patient demographics and clinical factors that may influence functional outcomes were included in the modeling and consisted of the following predictors: age, sex, race/ethnicity, marital status, preinjury employment status, years of education, mechanism of injury, rehabilitation length of stay (LOS), insurance status (primary payer), duration of posttraumatic amnesia (PTA) since injury, and medical comorbidities at acute hospitalization (using Charlson Comorbidity Index, CCI).

Results: The results revealed that PTA was the only variable that was consistently associated with all functional outcome scores (DRS and FIM) at both discharge from inpatient rehabilitation and 1 year following injury, when controlling for the influence of patient characteristics, injury severity, and clinical factors. There was appreciable variability in intercepts and slopes, meaning that the linear relationship between outcome and level 1 predictor differed across centers.

Conclusions: The use of HLM analyses demonstrated a center effect due to variability in the relationship between PTA and patient functional outcomes that included FIM and DRS total scores at discharge and 1 year post-TBI. Future studies examining variations in patient outcomes between centers should utilize HLM to measure the impact of additional factors that influence patient rehabilitation functional outcomes.

Clinical Relevance: Results from the current study have important implications for rehabilitation clinicians in the TBIMS. Individuals with TBI achieved different levels of functional improvement depending on the center where they received treatment. From a clinical standpoint, it is imperative to ensure that patients, regardless of center receive the same interventions and treatments to ensure successful patient outcomes. Further research is necessary to examine other factors (size, geographical location, intervention/treatment, technology, rehabilitation equipment, etc.) that influence functional outcomes between TBIMS centers. In this way, clinicians can share resources to provide patients who have sustained TBI with the highest quality of care.
ABSTRACT BODY:

Abstract Body: Purpose: The National Institutes of Health Rehabilitation Coordinating Committee suggested that rehabilitation research include an evidence-based approach for “device development” using processes that embrace the perspectives of individuals with disabilities. This theory report will describe the concept of Photovoice and expand its use with videography which will allow individuals with stroke (IwS) to articulate opinions about solid ankle foot orthoses (sAFOs) regarding fit, function, appearance, maintenance and/or impact on life.

Literature Review: Photovoice is a qualitative, photo-ethnographic methodology in which participants are co-researchers and considered experts in their life experiences. Methods utilized in Photovoice can also be applied via videography, both being mediums for self-expression. Photovoice has been used in stroke rehabilitation to describe quality of life at the participation level in speech, recreation, and occupational therapies by IwS; however, there are no Photovoice studies addressing user preferences and wearing adherence of sAFOs. Quantitative and qualitative studies indicate IwS report that prefabricated and customized AFOs augment walking ability, diminish perceived subjective or energy exertion, and enhance self-confidence. Photovoice and videography studies could serve to inform physical therapists (PTs) and orthotists of key information to be considered pre and assessed post fabrication.

Research Methods: Purposive sampling will be used to recruit 15 IwS. A photograph of the sAFO, another with IwS wearing the sAFO, and a video performing a task wearing the sAFO will be taken. IwS will answer questions using the SHOWeD method: What do you See here? What’s really Happening here? How does this relate to your life? Why does this problem exist? And what can we Do about this? IwS will provide a quote to describe each photograph and video and choose which quotes will be discussed in a focus group (FG). Interviews will be transcribed verbatim. NVIVO™ will be used for data organization. Thereafter, a framework approach (familiarization, thematic grouping, categorical organization, categories compared – indexing, new terms developed – charting, and mapping and interpretation of themes to data) will be used to determine themes that will be presented at the FG after a data verification process. After viewing photographs and videos, FG participants will generate themes utilizing the framework approach representing quotes provided. FG themes will be compared to the interview-generated themes.

Clinical Relevance: The proposed research can provide a frame of reference to PTs and orthotists to redefine how sAFOs are fabricated, modified and maintained. If wearing an AFO improves certain aspects of gait impairments, then to assure wearing adherence as an indication of user satisfaction and perceived sAFO value, gaining perspectives of IwS to improve sAFO customization would be valuable.
Title: High Repetition And Dose-Specific Training To Improve Function In Community Dwelling Adult After Stroke.

Authors/Institutions: S.S. Tomlinson, Physical Therapy, Arcadia University, Glenside, Pennsylvania, UNITED STATES| C. Yee, Outpatient Neuro, Kessler Institute for Rehabilitation, Kendall Park, New Jersey, UNITED STATES

Abstract Body:

Background & Purpose: Stroke rehabilitation studies cite that high repetitions show improved outcomes for patients in an acute rehabilitation setting. Research specifies dosing for upper extremity rehabilitation, but is limited in quantifying the number of repetitions in lower extremity rehabilitation. This case report examines a treatment approach including dose-specific interventions that are high repetition and task-oriented for a patient post-stroke in an outpatient facility.

Case Description: An 82 year old male three months post right medullary stroke presented to outpatient physical therapy with left (L) sided weakness, gait dysfunction and decreased balance. Examination revealed overall 4-/5 lower extremity (LE) strength, mild hypertonicity on L LE and right (R) lateral lean. Gait deviations included decreased L heel strike, decreased R stride length and L stance time, decreased L knee flexion from initial swing into stance, and loss of balance with turning R. Interventions for 22 visits over 14 weeks targeted 50-80 repetitions of segmental pre-gait and balance activities. Pre-gait activities included stepping over a bolster to promote L stance and R stride length. Balance interventions included step-ups of progressing height and surfaces with arm swing, exaggerated step length with manual cuing on arm swing, cone targets with trunk rotation and overreaching to encourage step reaction. Sessions ended with functional activities including ambulation with varying levels of verbal, manual, and tactile cues. To enhance motor learning, cues decreased as repetitions increased. Additional functional gait and balance training was performed to integrate new motor skills to allow further carry over with tasks at home and in the community.

Outcomes: The patient made significant functional gains, surpassing most initial therapy goals. Timed Up and Go improved from 31.5 to 22.2 seconds (Minimal Detectable Change (MDC) = 2.9 seconds), 30-Second-Chair Rise test increased from 5 to 8 repetitions and now without upper extremity support (Minimal Clinically Important Difference (MCID) = 2 repetitions for hip osteoarthritis), 2 Minute Walk Test increased from 30 to 60 meters with rolling walker (RW) (MDC=13.4 meters), and preferred gait speed increased from 0.45 to 0.61 meters/second (MCID=0.16 m/s) with improved quality. Ambulation improved from RW with moderate assistance to RW with close supervision and no RW with close supervision/contact guard for household distances, thus increasing independence.

Discussion: This case illustrates LE dosing of a high repetition intervention strategy for patients post stroke in an outpatient setting. Although the patient's scores were still in the range of falls risk, functionally, the patient was safer with ambulation. This intervention model can serve as a suggested dosing regimen for patients at risk of falls but with goals to return to community ambulation. Limitations included therapy time in outpatient care, age-influenced physical abilities with exercises, and adherence with a home exercise program.


TITLE: Effect of Rowing Induced Fatigue on King-Devick and Postural Sway: Preliminary Data

AUTHORS/INSTITUTIONS: A. Stanley, Department of Physical Therapy, Radford University, Sterling, Virginia, UNITED STATES|E. Boggs, B. Harper, A. Aron, Physical Therapy, Radford University, Roanoke, Virginia, UNITED STATES|O.R. Willson, physical therapy, Radford University, Roanoke, Virginia, UNITED STATES|R. Andrews, Doctor of Physical Therapy Student, University Radford, Roanoke, Virginia, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: To determine if whole-body fatigue has an effect on King-Devick test scores or postural sway.

Number of Subjects: 8 subjects (3 females, 5 males) between the ages of 18-30 years

Materials/Methods: Pre-and-posttest scores for King-Devick (K-D) and Modified Clinical Test of Sensory Interaction in Balance (M-CTSIB) as measured by the Biodex BioSway were obtained immediately prior to and upon cessation of exercise on a convenience sample of healthy subjects. The fatigue protocol consisted of a 2-minute warm-up followed by rowing at a metronome pace of 75 bpm. Every two minutes the pace was increased by one bpm until subjects reached fatigue determined by meeting three of four criteria: ≥90% MaxHR, inability to maintain metronome pace for three consecutive pulls to the abdomen, ≥17/20 on the RPE scale, and inability to maintain form. Heart rate was monitored throughout with PolarBeat H7 chest transmitter.

Results: K-D scores and postural sway were not different after subjects reached a state of fatigue (P>0.05). The difference between pre- and post-K-D scores correlated to the difference in postural sway on a firm surface with eyes closed (p=0.04, r=-0.7). Regression analysis showed a predictive relationship for eyes closed on a firm surface with a 44% change in K-D scores.

Conclusions: Preliminary data indicates whole-body fatigue such as that experienced by athletes during sporting events may not influence K-D scores or overall postural sway. This would support use of the K-D test for sideline concussion screening. However, data indicates during a state of fatigue, there is a predictive relationship in which higher post K-D scores correlated with decreased sway on a firm surface with eyes closed. Further studies may show a correlation between fatigue and improved somatosensory function.

Clinical Relevance: The K-D test is utilized as an objective sideline concussion screening test to assess cognitive processing speed, rapid eye movement, and visual tracking. These factors are used to interpret suboptimal brain functioning and to determine if further balance deficit testing is warranted. To date, no research has been conducted to determine if whole-body fatigue may mimic suboptimal brain function resulting in false-positive K-D scores, which lead to removal of an athlete from play.
TITLE: A comparison of gait dynamics when using an ankle foot orthosis versus no ankle foot orthosis in people with hemiplegia secondary to stroke

AUTHORS/INSTITUTIONS: J.H. Hollman, Physical Therapy, Mayo Clinic, Rochester, Minnesota, UNITED STATES | B. Beckman, Physical Medicine and Rehabilitation, Mayo Clinic- Saint Marys Hospital, Rochester, Minnesota, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Hemiplegia following stroke is commonly associated with gait pathology characterized by reduced speed and symmetry. An intervention often aimed to offset these pathologies includes prescribing ankle foot orthoses (AFOs) to improve safe and efficient ambulation. Gait pathology can also be examined through nonlinear analyses of fluctuations across repeated strides, although effects of AFOs on these gait dynamics have not been reported. The purpose of this study was to examine whether complexity and fractal dynamics across repeated strides change when patients with hemiplegia wear an AFO. We hypothesized there would be greater nonlinear changes compared to linear changes as well as increased complexity in stride time across repeated strides when a patient wears an AFO versus when they are not wearing an AFO.

Number of Subjects: Five subjects (2 males, 3 females) with hemiplegia following a stroke have participated in the study. Subjects were selected via a sample of convenience, including subjects known to the primary investigator. All subjects were people with hemiplegia secondary to chronic stroke with cerebral hemorrhage or ischemia in either hemisphere.

Materials/Methods: Participants completed a 6-minute walk test with and without an AFO. The testing order was randomized. Ten minutes of recovery between testing bouts were allotted. Gait parameters were measured using an APDM Movement Monitoring inertial sensor system (APDM Inc., Portland, OR). Mean stride time and velocity measurements were compared between walking conditions. Nonlinear measurements including sample entropy and fractal exponents in participants’ stride times were used to compare gait dynamics between walking conditions.

Results: Stride length remained consistent or slightly increased (d=.17) while wearing the AFO. Stride time remained consistent or slightly increased (d=.32) while wearing the AFO. Gait speed remained consistent or slightly increased (d=.16) while wearing the AFO. However, the complexity of the stride time signal increased (d=.54) while wearing the AFO. Participants experienced a 5% change in stride time, an 11% change in sample entropy and a 13% change in the fractal exponent across several hundred strides when wearing an AFO.

Conclusions: Based on initial results, the magnitude of change in gait associated with wearing an AFO was greater when stride time dynamics were examined with nonlinear measures of stride to stride fluctuations than when traditional measures of mean stride times were examined. Further work is needed to better define how nonlinear analyses characterize gait pathology in hemiplegic gait and to assess the effectiveness of interventions that are intended to improve patients’ ambulation abilities.

Clinical Relevance: Nonlinear measurements of stride time dynamics may be more sensitive indicators of changes in gait associated with AFO use in patients with hemiplegia following stroke than traditionally used spatiotemporal gait parameters.
TITLE: Increased prefrontal cortical activity during typical walking is associated with greater dual-task costs after stroke


ABSTRACT BODY:

Purpose/Hypothesis: Walking in healthy adults is largely automated, with occasional demands on executive resources for motor planning and attention. In contrast, the automaticity of walking is reduced post-stroke, along with a compensatory increase in the reliance on executive control of walking. This increases the susceptibility to decrements in walking performance when cognitive tasks are performed simultaneously. Measuring activity in the prefrontal cortex using functional near infrared spectroscopy (fNIRS) is a promising approach for quantifying the demand on executive control during walking. We investigated the agreement between fNIRS and dual-task costs for assessing the reliance on executive control of walking after stroke. We hypothesized that adults post-stroke with increased prefrontal activity during typical walking will also demonstrate decrements in walking performance while dual-tasking.

Number of Subjects: 18 post-stroke

Materials/Methods: Participants performed three walking tasks: typical walking at their preferred speed (control task), dual-tasking walking with a verbal fluency task, and dual-task walking with a serial-seven subtraction task. A portable commercially available fNIRS monitor was used to evaluate prefrontal activity, quantified as the Oxygenated Hemoglobin Concentration (O2Hb) and as the prefrontal Tissue Oxygenation Index (TOI). An electronic walkway was used to measure spatiotemporal gait parameters.

Results: Prefrontal activity (measured as TOI) during the typical walking ‘control’ task was significantly associated with measures of dual-task cost of gait (e.g., step length) and cognitive performance (i.e., number of responses/second). Consistent with prior literature, gait performance deteriorated during dual-task walking. Gait speed, step length, step width, and double support time were significantly different between the control task and the two dual-task walking conditions (p<0.05). Furthermore, O2Hb was also significantly greater during each dual-task walking condition compared to the control task (p<0.05). TOI was significantly greater during the subtraction dual-task (p<0.05), and was trending towards higher values during the verbal-fluency dual-task condition compared to the control task (p=0.09).

Conclusions: There was an agreement between fNIRS and dual-task costs for assessing the increased reliance on executive control of walking in adults post-stroke.

Clinical Relevance: Increased reliance on executive control during walking can decrease the ability to attend to potential threats in the immediate environment such as an oncoming vehicle, which may compromise safety. This study supports the use of fNIRS to measure the increased reliance on the executive control of walking. Importantly, fNIRS might be useful as an alternative to the traditional approach of using dual-task assessments to evaluate the cognitive demands of walking. This is a promising approach that could identify individuals at an increased risk for falls due to excessive reliance on executive control of walking, and should be investigated further.
A Case Study Demonstrating the Benefits of Physical Therapy Service Trips for an Individual with a Progressive Neuromuscular Disease Without Reliable Healthcare.

Nicaragua is the poorest country in Central America where 35-40% of the population has access to reliable health care, making household family caregivers important.1 Worldwide, there are more than 10 million people living with Parkinson’s disease (PD) with prevalence rising by age.2 The purpose of this case discussion is to examine benefits of a physical therapy world health service trip on an individual with PD who did not have reliable healthcare.

A 60 year old male living in Nicaragua with PD presented as stage 2.5 on the Modified Hoehn & Yahr scale.3 He was evaluated by a physical therapist (PT) and student physical therapists (SPTs) completing a week long service trip. At initial visit the patient (pt) was expressionless, stoic, soft speaking, and required assistance for all ADLs from family. Pt. owned a standard walker, but did not use independently due to the pt’s inability to maneuver the device safely. He reported being afraid of standing up due to tremors, weakness, and previous falls. Ten hours per day were spent sitting in a rocking chair with minimal social interaction, contributing to decreased mobility, limited LE ROM (-15° B knee extension), decreased strength (maximum 3x sit to stand with MIN A and B UE support), 20° resting thoracic flexion in standing, with minimal expressions. His initial endurance level was one minute of exercise before rest was needed, due to fatigue and pain. Treatment focused on providing a rolling walker (RW), music therapy, dancing, big movements, safety, and education to both the patient and family.

Pt. received physical therapy in his home three times throughout the week (total of three hours). At the final visit, the pt was able to perform a sit to stand and dance with contact guard assist (CGA) by family members. His endurance progressed to only three rest breaks over the final 60min session which consisted of ambulating 50 meters CGA with a RW, performed 3x10 sit to stand CGA, 10 min of dancing with min A. Pt also had improved expressions including a smile, demonstrating enjoyment and a change from the initial session.

Service trips provide cost effective, high quality healthcare to individuals in countries where affordability and/or equity is difficult to obtain.4 Individuals are not getting proper and timely treatment from a medical professional. Service trips allow healthcare providers, in conjunction with local entities, to provide sustainable services in poor countries, like Nicaragua.5 These services are needed to improve world health, increase quality of life, and decrease morbidity. For our pt, this service trip improved the understanding of PD for him and his family, while increasing his happiness as evidenced by the following quote, “Volvio la vida” translating to “you restored my life”. Although most world health service trips are short-term, their benefits on individual lives are extensive by catalyzing sustainable and long standing impacts.6,7,8

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): 1. Sequeira M, Espinoza H, Amador JJ, Domingo G, Quintanilla M, and de los Santos T. The Nicaraguan Health System. Seattle, Washington: PATH; 2011.
8. Chapin E, Doocy S. International short-term medical service trips: Guidelines from the literature and perspectives
Correcting the Imbalance Between Self-Efficacy and Functional and Participation Deficits with Balance Based Torso Weighting for a Patient Post Cerebrovascular Accident

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Background & Purpose: Balance-based torso weighting (BBTW) has been shown to increase gait kinematics, postural control, energy conservation, and reduce falls in individuals with Multiple Sclerosis. However, studies evaluating the effects with other patient populations have not been completed and the change in self-efficacy and capacity for individuals to independently perform therapeutic levels of activity has not been well documented.

Case Description: The patient, a 68 y/o male, presented to the UIW Community Clinic on September 8, 2016, status post CVA in September 2014. The patient had completed approximately 180 PT sessions prior to initiating care in our clinic. In the UIW Community Clinic, the patient participated in 20 PT sessions with standard of care interventions. In March 2017, assessment for BBTW was performed and revealed a loss of balance in bilateral rotation and right lateral directions. Five weights, totaling less than five pounds, were strategically placed on a BalanceWear® Orthosis (BWO) to stabilize static and reactive balance control. The Montreal Cognitive Assessment (MOCA) was also performed with the patient scoring 20/30.

Outcomes: After three visits which focused on weighting prescription, and two weeks of wearing the BalanceWear Orthosis for up to six hours a day, the patient’s Timed Up and Go (TUG), with single point cane (SPC), improved from 24.29 seconds to 15.87 seconds, and the TUG with Cognitive Dual Task (TUG-COG) improved from 32.13 seconds to 17.50 seconds. Improvements were noted at the impairment, activity, and participation levels of the International Classification of Functioning, Disability, and Health (ICF) model. Decreased back pain was reported, resulting in Percocet dose change and increased mental alertness. These cognitive improvements allowed greater participation in roles and responsibilities. Functional changes included the ability to ambulate to the restroom at night, and independent performance of instrumental activities of daily living (IADLs). Changes the patient valued most were improvement in contextual factors and most importantly, self-efficacy, as they were paramount in affecting participation and performance changes within the home and community.

Discussion: Despite the chronicity and complexity of the patient case, addition of BBTW to the patient’s plan of care facilitated improvement in TUG, TUG-COG, patient confidence, and an increase in both the intensity and frequency of activities outside the clinic which may drive functional changes needed for further recovery. Similar results were not obtained with PT standard of care. These outcomes suggest that use of BBTW may be an effective tool for treatment of patients with chronic balance impairments due to CVA. However, further studies are needed, with larger sample sizes, to determine the broader application of BBTW for individuals with CVA and other diagnoses where balance is impaired, and to evaluate the relationship between BBTW and self-efficacy.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: Effects of Ekso Training on Walking Function and Health in People with Incomplete Spinal Cord Injury: A Case Series

AUTHORS/INSTITUTIONS: A. Domingo, R. Tam, S. Willcocks, M. Goff, S. Colwell, Doctor of Physical Therapy Program, San Diego State University, San Diego, California, UNITED STATES| J. Kressler, School of Exercise and Nutritional Sciences, San Diego State University, San Diego, California, UNITED STATES

ABSTRACT BODY:

Background & Purpose: The purpose of this case series is to explore how overground bionic ambulation (OBA) training using the Ekso GT, a robotic device that enables overground walking for those with weakness and paralysis, affects walking performance and other aspects of health and function for individuals with motor-incomplete spinal cord injuries (SCI). The Ekso provides variable assistance during walking, allowing individuals to utilize residual motor function, thereby increasing participant engagement and task specific practice. We hypothesized that after training in the Ekso, individuals with motor-incomplete SCI would demonstrate improved walking speed, walking distance, balance, gait quality, bowel function, and pain.

Case Description: Four participants with motor-incomplete SCI trained 1-2 days per week for 12 weeks in the Ekso with variable assistance. Individuals were prescribed a swing phase trajectory to follow and were encouraged to use their own muscle power to maintain the trajectory during walking in the Ekso. As the participant’s ability to follow the trajectory improved, we lowered the maximum amount of assistance that the Ekso could provide to the participant. Training sessions lasted one hour with rest breaks as needed. Several objective and subjective measures were taken pre- and post-training (without the device). Objective measures included: the 10 meter walk test, 6 minute walk test, Berg Balance Scale, the SCI Functional Ambulation Inventory, Walking Index for Spinal Cord Injury, and movement variability during walking. Subjective measures included: Activities-specific Balance Confidence scale, Self-Reported Functional Measure, Brief Pain Inventory, Neurogenic Bowel Dysfunction Score, and the International Physical Activity Questionnaire.

Outcomes: After training, 3 of 4 participants showed improvement in balance confidence, with 1 subject moving from low physical functioning to high physical functioning. Two of four showed improvements in balance function, with 1 subject moving from high fall risk to medium fall risk. Three of four subjects showed improvements in gait quality. There were no improvements in walking speed or endurance. Two of four subjects needed less assistance with daily activities, and in 3 of 4 subjects, bowel function improved and pain decreased.

Discussion: Overall, OBA training with variable assistance may improve various aspects of health, function, and quality of life for individuals with motor-incomplete SCI. Therapeutic interventions that improve mobility after SCI can lessen secondary complications from reduced physical activity. This case series is one of the first to show that OBA with variable assistance can improve balance and gait quality in individuals with motor-incomplete SCI. Larger, controlled studies are needed to elucidate optimal OBA training parameters to maximize functional and health outcomes.


TITLE: The impact of social relatedness within a group exercise setting in persons with Parkinson’s Disease.

AUTHORS/INSTITUTIONS: R. Lewthwaite, Physical Therapy, Rancho Los Amigos National Rehabilitation Center, Downey, California, UNITED STATES|N.D. Matthews, University of Southern California, Los Angeles, California, UNITED STATES|C. Lochala, N. Thomas, S. Marchbanks, B.E. Fisher, Biokinesiology & Physical Therapy, University of Southern California, Los Angeles, California, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Current perspectives have identified the role of exercise in behavioral recovery and neuroplasticity in Parkinson’s disease (PD). Accordingly, effort has been directed to identify the forms of exercise that improve motor function. Yet, PD affects many life domains and is often experienced as socially isolating. Social influence not only can motivate exercise behavior but social relatedness motivation can affect motor performance. In this preliminary study, we therefore sought to understand the perceived benefits of three distinct forms of group exercise (boxing, tai chi, and line dancing) to individuals with PD.

Number of Subjects: 23

Materials/Methods: Forty-three community-dwelling individuals with Parkinson’s disease (aged 49-88 years) were invited to participate in an individual interview after completion of a once weekly 8-week boxing, tai chi or line dancing class offered in the community. Twenty-three of these individuals (boxing: 5 females and 5 males; tai chi: 3 females and 4 males; line dancing: 5 females and 1 male) agreed to participate. Interviewers used a 14-question guide that asked about the individual’s experience, value, and perceived impacts of the exercise classes. Interviews were transcribed by two members of the interview team and a thematic content analysis of data was performed.

Results: All 23 subjects reported benefits in the areas of physical and social well-being. Twenty-one participants described mental well-being effects from their activity. Many participants reported improved confidence: “What it gives me was the sense that more is possible, that I can do these things that … I questioned before;” “…it gives me the confidence to go forward and not be afraid, and not worry about what’s going to happen ten years from now.” Fourteen individuals, particularly from the boxing and line dancing classes, reported that social engagement was the primary benefit of their class participation. As one participant explained, “if you don’t have that…camaraderie, and that sense of familiarity with someone else, you’re alone. So it gives you that sense of not being alone.” A majority of participants in the boxing, but fewer in the other two class types, indicated class benefits were due to the social engagement experienced in the class rather than the actual activity performed.

Conclusions: Our preliminary data suggest that the benefits of physical activity or exercise class participation for individuals with Parkinson’s disease may stem as much from opportunities for social interaction or satisfaction of social-relatedness needs as from the physical or physiological impacts provided with exercise or a given form of motor activity. Additional studies with multiple activities may shed light on the effects of particular forms of activity on a range of motor and non-motor outcomes in PD.

Clinical Relevance: The insights from these interviews may assist clinicians, instructors, and individuals with Parkinson disease in their decisions regarding activities of this nature.
Purpose/Hypothesis: Postural instability is one of the major functional complications in Parkinson’s disease (PD). Contributions to this multifaceted problem are sensory motor integrative dysfunction, biomechanical alterations in posture, bradykinesia, cognitive processing deficits and axial rigidity. Computerized dynamic posturography (CDP) provides analysis in both static and dynamic postural conditions and offers insight to the underlying aspects contributing to postural dysfunction. Therefore, the purpose of this study is to define the factors in postural control deficits in individuals with PD. The study hypotheses states that individuals with PD undergoing CDP testing will demonstrate: 1) limitations in specific sensory condition(s) in the Sensory Organization Test (SOT); 2) reductions in voluntary movement velocity and directional control in the anterior posterior and medial lateral plane in the Rhythmic Weight Shift (RWS) Test and Limit of Stability (LOS) Test and 3) standing weight asymmetry in the Motor Control Test (MCT).

Number of Subjects: 8 individuals, 3 female and 5 male, Hoehn and Yahr (H and Y): Stages I to V with a mean age of 67.4 years of age (± 6.1).

Materials/Methods: This is a retrospective study from completed interventional research involving individuals with PD. All participants were tested with the CDP device, Bertec Advantage Balance undergoing static and dynamic plate assessments. Two physical therapy students were trained in the testing protocols and implemented CDP testing. Each subject wore a dynamic balance harness during testing and were assessed in the following order: 1) SOT, 2) LOS, 3) RWS and 4) MCT. All subjects remained on medication in the ON condition. Results for each test and conditions were analyze with age based normative values.

Results: In the six conditions of the SOT, the subjects fell within the norms for conditions 1 through 3, however half of the participants experienced at least one fall in conditions 4 and 5, with only one individual meeting normative values. Directional control for all individuals in both anterior posterior and medial lateral planes were below age normative values. Additionally, 7 out of the 8 subjects demonstrated medial lateral standing asymmetries in the MCT.

Conclusions: In spite of the wide range of H and Y classifications, the stated hypotheses were met. Mean scores in the SOT conditions 4 and 5 fell below age normative values. Furthermore, a mix of left and right asymmetrical standing was found during the MCT. In the RWS, all subjects showed below age normative values for directional postural control.

Clinical Relevance: This retrospective study offers a starting point for analyzing a range of postural deficits in individuals with PD. Specifically, the study reveals similar deficits in the areas of visual and vestibular postural control and controlling posture in all planes. Result findings will initiate a framework for a targeted interventions focusing on specific features in postural dysfunction in PD.
Suitability of a narrowing beam walking task to assess balance in acute incomplete spinal cord injury: a case report

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Background & Purpose: Falls are a major health concern in individuals with incomplete spinal cord injury (iSCI).1,2 A barrier to mitigating the negative consequences of falls is effective prospective screening. Existing clinical balance tests like the Berg Balance Scale (BBS) and Timed Up and Go (TUG) have been advocated as screening tools. However, they do not pose sufficient challenge to discriminate between individuals with iSCI with and without a history of multiple falls,3,4 or between paraplegia and tetraplegia.5 Thus, existing clinical balance tests do not provide sufficient sensitivity to identify important differences in balance.3,4,6 Additionally, there are a lack of measures available for capturing higher level balance deficits.7 To address this gap, tests that pose greater challenge to balance control like narrow path8,9 and beam walking10,11 have been developed, and show potential in other patient populations. However, they remain unproven among individuals with iSCI. The purpose of this case study was to assess the suitability of a beam-walking task to evaluate balance ability in an individual with an acute motor iSCI compared to existing balance tests.

Case Description: One 23-year-old female with an L3 American Spinal Injury Association Impairment Scale (AIS) C SCI was evaluated five times 2-6 months post-injury.

Outcomes: At each test session, lower extremity motor scores, Walking Index for Spinal Cord Injury (WISCI) II, BBS, TUG, and 6 trials of a novel narrowing beam walking task (NBWT) were administered with the participant using her current assistive device(s) for ambulation (e.g. straight cane and small base quad cane). The NBWT is a novel balance assessment where individuals attempt to walk along a low beam surface that progressively narrows from 8 inches to 1 inch over 24 feet. Performance is scored based on the average distance walked until the participant steps off.

The subject’s BBS score improved from 26 to 43/56 over the 5 sessions and her WISCI II score improved from 10 to 20/20. She was able to complete the TUG and ambulate further distances on the NBWT using progressively less supportive assistive devices at each session. However, she was unable to perform the NBWT without an assistive device until the final session 6 months post-injury.

Discussion: The NBWT is a challenging task to evaluate balance in an individual with acute L3 AIS C SCI. Tandem stance and single limb stance are difficult for individuals with iSCI, both of which are requirements of the NBWT.11 The NBWT appears most suitable for individuals in the chronic stages of iSCI (> 6 months post-injury) who ambulate without an assistive device. The BBS and TUG were sufficiently challenging in this case to assess balance in the acute stage of iSCI, although both are susceptible to ceiling effects1. Future studies with larger samples are needed to fully evaluate the feasibility of the NBWT for measuring balance and fall risk in both acute and chronic iSCI.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Temporary proprioception interference via somatosensory stimulation: A protocol for the upper limb

AUTHORS/INSTITUTIONS: A.L. Borstad, J. Bjorklund, B. Haag, T. Kramer, S. Oczak, J. Janz Vernoski, Physical Therapy, College of St. Scholastica, Duluth, Minnesota, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Proprioception, an important component of sensorimotor performance, is commonly impaired in individuals with upper motor neuron syndrome, yet clinicians lack valid and reliable tools to quantify it. A standardized protocol to non-invasively knockdown upper limb proprioception is needed as clinicians and researchers work together to develop and test new quantitative measures of upper limb sensorimotor performance. The purpose of this project was to test a protocol designed to temporarily interfere with upper limb proprioception in healthy adults. Interference was confirmed using a clinic ready measure thought to reflect 1a afferent axon transmission, the Vibration Detection Threshold (VDT). Subsequently, the test-retest reliability, minimum detectable difference (MDD), and effect size of VDT was determined.

Number of Subjects: 20 healthy adults (8 M; 32.5 +12.5 years) participated.

Materials/Methods: Participants were tested one week apart using two measures. VDT, the duration in seconds that an individual perceives vibration from a 128 Hz tuning fork, was quantified at the distal biceps tendon. The mean of three trials was used for analysis. The tablet version of the Brief Kinesthesia Test (tBKT), which measures error of targeted reaching with visual occlusion across 20 trials, was also quantified. Both measures were taken bilaterally. At test session two, participants completed the same measures under the condition of temporary proprioception interference induced by applying continuous 183 Hz vibration to the ulnar nerve. A repeated measures design evaluated VDT test-retest reliability. The extent of proprioception impairment that resulted from the protocol was quantified by calculating the effect size (Cohen’s d). Participants provided written informed consent for this IRB approved study.

Results: The proprioception interference protocol resulted in statistically poorer performance scores on the VDT (t=14.25, df=39, p<0.0001) and tBKT (t=3.7, df=19, p<0.0016). The effect size of proprioception interference on the VDT and tBKT was, d= 2.31 and d=0.87, respectively. The standard error of measurement for the VDT was 1.35 seconds, 95% CI= 5.7-10.9 seconds, the MDD was 3.1 seconds. The intraclass correlation coefficient of the VDT was (ICC 1, k*)=0.76, n=40.

Conclusions: Upper limb proprioception interference using vibration had a consistent, robust effect and was practical to apply. The VDT had good test-retest reliability and showed a large effect to the interference condition. Future studies could examine the VDT’s sensitivity to impairment in clinical populations with upper motor neuron syndrome.

Clinical Relevance: Because clinicians lack methods to quantify upper limb proprioceptive performance, this common impairment is under recognized and under treated. This study documents a protocol that effectively, temporarily, interferes with upper limb proprioceptive performance. This protocol can be used in future studies focusing on the development of quantitative methods of measuring upper limb sensorimotor performance in the clinic.
Purpose/Hypothesis: For persons utilizing a wheelchair for mobility, there are few easily administered and reliable tests to define mobility. The Wheelchair Propulsion Test (WPT) was designed to be a quick and easily administered test in a clinical or research setting to indicate a user’s functional level. Our purpose was to determine the inter-rater reliability and typical values of the WPT among high functioning wheelchair users.

Number of Subjects: n=12, mean age 36.2±12.6 years, length of wheelchair use 8-22 years. Pathologies which required wheelchair use included: thoracic and lumbar spinal cord injury, fused spine and birth deformities. Subjects were considered high functioning if they could independently perform 4/5 preselected typical activities of daily living.

Materials/Methods: A 10m distance with an extra 2m acceleration and a 2m deceleration was used for WPT. Subjects performed 3 trials of WPT at comfortable and fast pace in 3 wheelchairs: their personal wheelchair, a lightweight and an ultra-lightweight wheelchair in randomized order. The time to complete the 10m distance (speed) was recorded with a stopwatch and the number of pushes (cadence) was counted by 2 testers. An ICC (2,3) was used to find the inter-rater reliability. One-way ANOVAs were used to determine differences in cadence and speed among the wheelchairs at each pace.

Results: The range of ICC values for either cadence or speed among the 3 wheelchairs was 0.962–0.998, indicating excellent reliability. Significant main effect for cadence at comfortable pace showed subjects had less number of pushes on their personal wheelchair (5.5±.4) compared to lightweight (6.6±.3; P=.027) and ultra-light (6.5±.4; P=.021) wheelchairs. There was a significant main effect for speed at comfortable pace (P=.038) but the post hoc tests showed no significant differences (personal, 1.7±.1m/s; lightweight, 1.5±.1m/s; ultra-light, 1.6±.1m/s). There was no significant main effect for cadence at fast pace (personal, 6.4±.5; lightweight, 6.8±.3; ultra-light, 7±.4). Significant main effect for speed at fast pace revealed that subjects pushed their personal wheelchair (2.8±.2m/s) significantly faster compared to lightweight (2.3±.1m/s; P=.016) and ultralight (2.4±.1m/s; P=.017) wheelchairs.

Conclusions: The WPT is a simple clinically administered test with high inter-rater reliability between testers using the stopwatch and counting frequency of pushes. The results suggest that a custom fit wheelchair may be faster at a fast pace and requires less pushes at a comfortable pace than a non-customized wheelchair.

Clinical Relevance: Results of our study indicate that high functioning wheelchair users may benefit from greater independence and increased functionality with a custom fit wheelchair, with an added benefit of decreased energy consumption allowing them to be more functional in daily activities. Depending on the individual and their needs, the added cost of a custom fit wheelchair may improve functionality.
Minimal Detectable Change for Gait Initiation in Individuals with Parkinson’s Disease

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ABSTRACT BODY:

**Purpose/Hypothesis**: Parkinson’s disease (PD) is characterized by gait deviations that progress with the disease, such as reductions of gait speed, stride length, and arm swing, as well as difficulty initiating gait. Our understanding of the psychometric properties of kinematic measures for gait initiation in patients with PD is limited. The purpose of this study was to determine the minimal detectable change (MDC), reproducibility, and diagnostic properties of kinematic and temporal measures of gait initiation in individuals with PD.

**Number of Subjects**: 17 individuals with mild-moderate PD (avg age 68.4 ± 11.8 years)

**Materials/Methods**: An investigator-blinded randomized controlled study assessed and calculated the MDC of temporal and kinematic variables of postural stability during gait initiation. Data was collected using the VICON™ motion analysis system and 2 AMTI force plates for kinetic outcomes. Each participant was instructed to move from a standing position to continuous gait down a 1- by 5- meter walkway. This task was performed 6 times- 3 off medication then 3 on medication 1 hour later. Reliability was estimated by calculating the Intraclass Correlation Coefficient (ICC). MDC scores were calculated for 8 components of gait initiation, on and off medication by multiplying the standard error of measurement by the z-score for a 95% CI, and the square root of 3 to account for the variance of 3 measurements. The motor subsection of the Unified Parkinson Disease Rating Scale (UPDRS) was used as an anchor along with MDC values for predicting motor impairments. Microsoft Excel (version 15.11.2) was used for statistical analysis.

**Results**: ICCs for all components of gait initiation were fair to excellent (0.411-0.966). The posterior COP shift and the lateral COP shift had the greatest discriminatory properties of gait initiation. Posterior COP shift on-medication had a sensitivity (Sn) 75%, and specificity (Sp) 67%. Posterior COP shift off-medication was Sn 50%, Sp 56%. Lateral COP shift on-medication yielded Sn 88%, Sp 44%. Lateral COP shift off-medication was Sn 25%, Sp 67%.

**Conclusions**: MDC values help to determine whether change in patient performance is reflective of true change beyond measurement error. Between-group differences demonstrate that PD patients off-medications yielded greater discriminatory results with gait initiation variables than when on-medication. Amongst the 8 variables, Lateral and Posterior COP shift variables were most predictive of gait impairments and could be used to rule in or rule out motor impairments based on MDC and UPDRS.

**Clinical Relevance**: Due to wearing-off effects of PD medications, motor performance may fluctuate throughout the day. Our results demonstrate that psychometric properties of gait initiation may differ between on and off-medication states. We suggest that testing patients during peak optimal performance (on-medications) should be complemented with ecologically valid assessments (off-medications).
ABSTRACT BODY:

**Purpose/Hypothesis:** Clinicians lack valid and reliable tools to quantify upper limb proprioception, a component of sensorimotor performance that is frequently overlooked. The Brief Kinesthesia Test (BKT) is a simple, clinically practical measure that quantifies error in targeted reaching with visual occlusion. Performance on the BKT is thought to reflect kinesthetic sense, one aspect of proprioception. A tablet version of the Brief Kinesthesia Test (tBKT) was developed in our lab with the goal of improving the psychometric properties of the BKT. The purpose of this study was to determine the test-retest reliability of the tBKT and its validity as a measure of upper limb proprioception.

**Number of Subjects:** 20 healthy adults (8 M; 32.5 ±12.5 years) participated.

**Materials/Methods:** A repeated measures design evaluated tBKT test-retest reliability. Participants were tested one week apart. Validity of the tBKT as a measure of upper limb proprioceptive performance was tested in two ways. The known groups method was used to look for statistical differences in tBKT scores between a control and a proprioception interference condition induced by applying continuous 183 Hz vibration to the ulnar nerve. Correlating tBKT scores with Vibration Detection Threshold (VDT) scores from the temporary proprioception interference condition tested convergent validity. VDT, the duration in seconds that an individual perceives vibration from a 128 Hz tuning fork, was quantified at the distal biceps tendon. The mean of three trials was used for analysis. Both measures were taken bilaterally. Participants provided written informed consent to participate in this IRB approved study.

**Results:** The mean (standard deviation) of error on the tBKT across 40 upper limbs for time point 1 and 2 was 1.18(0.24) cm and 1.30(0.36) cm respectively. The standard error of Measurement was 0.21 cm. The Minimal Detectable Difference was 0.49 cm. The Intraclass correlation coefficient was (ICC 1, k*) = 0.65, n = 40. Statistically significant differences in tBKT between the control and proprioception interference condition (paired t-test) for both the left (t = 4.4, df = 19, p,<0.0003) and right (t = 3.7, df = 19, p<0.0016) upper limb were found. The correlation between tBKT and VDT scores during the proprioception interference condition was not significant (r = 0.22, p = 0.17).

**Conclusions:** The tBKT had moderate test-retest reliability and is a valid measure of upper limb proprioception based on the known-groups method, however, rather than converging, impairment condition scores on the VDT and tBKT diverged suggesting the measures examine different aspects of proprioceptive performance.

**Clinical Relevance:** Impaired proprioception is largely invisible and quality measures are lacking; as a result, it is under diagnosed and undertreated. This study prepares the foundation for clinical studies of the tBKT. When clinicians can access valid and reliable measures that quantify proprioceptive performance, appropriate treatments can be implemented, and the outcome of those treatments objectively quantified.
**Title:** Awareness, Attitudes & Beliefs about Fall Risk and Evidence-Based Falls Prevention Programs Among Community Dwelling Older Adults

**Authors/Institutions:** S.R. Kiami, Physical Therapy, Movement & Rehabilitation Sciences, Northeastern University, Boston, Massachusetts, UNITED STATES | R. Sky, Foundation for Healthy Communities, Concord, New Hampshire, UNITED STATES

**Abstract Body:**

**Purpose/Hypothesis:** Falls among older adults are a critical public health issue. Falls are the leading cause of accidental injury and death among older adults. Costs of treating falls in the United States are expected to reach $59.6 billion by 2020. Many falls are preventable though, and evidence-based falls prevention programs with an interdisciplinary focus have been shown to reduce fall risk. Unfortunately, most older adults are not given information about how to reduce risk, and falls prevention programs are under-enrolled. The purpose of this study was to identify older adults awareness, attitudes and beliefs about fall risk and fall prevention programs, as well as self-reported facilitators and barriers to participation.

**Number of Subjects:** 369

**Materials/Methods:** A convenience sample of older adults aged 60-101 years old were recruited from 16 healthcare and senior center sites across the state of New Hampshire. Participants completed a survey on falls developed by the authors using the construct of the health belief model.

**Results:** Participants understood the negative impact falls have on quality of life, and reported self-efficacy, or a belief that there are steps they can take to reduce fall risk. Subjects reported a high likelihood to register for falls prevention programs, however the majority were not aware of falls prevention programs in their area, nor did most talk to their doctors about fall risk. Participants were more likely to speak to their doctor about falls if they were more at risk, however speaking to their doctor did not make it more likely that they would register for a program. The two most commonly reported facilitators to participation in falls prevention programs, “offered close to home” and “no cost-free,” were also found to be statistically significant in relation to likelihood to register for a falls program.

**Conclusions:** Fall prevention program directors are encouraged to 1) seek a wide range of health care providers in a variety of settings to educate older adults about falls and fall prevention programs, and 2) utilize multiple methods to market programs to community dwelling older adults rather than relying upon physician referrals. Additionally, programs should be offered close to older adults’ homes at no cost as these two factors were found to be both facilitators to participation and factors which would make them more likely to register for a falls prevention program. For older adults living in rural areas, free access to falls prevention programs via telemedicine options should be explored.

**Clinical Relevance:** Reducing morbidity and mortality as well as healthcare costs from falls is a public health imperative. Programs need to be aggressively marketed, and delivered with potential facilitators and barriers addressed, to improve awareness and participation rates. Currently, most older adults are not aware of falls prevention programs and attendance rates are low which may be adversely affect their health and wellness, and be contributing to rising healthcare costs.
ABSTRACT BODY:

**Purpose/Hypothesis:** The purpose of this study was to determine feasibility and compare acute changes in locomotor function following single bouts of continuous (CT), interval (IT), and treadmill self-selected speed (SS) training, matched for total distance, in ambulatory individuals with chronic stroke. We hypothesize IT will elicit the largest gains.

**Number of Subjects:** 23 individuals participated in this study.

**Materials/Methods:** All participants attempted all three treadmill exercise sessions (CT, IT, and SS). Overground self-selected walking speed (SSWS) was used for CT training, while IT involved a 1:1 ratio (1 min slow : 1 min fast walking) with the goal of fast walking at 150% of overground SSWS and slow walking at 50%. If subjects did not achieve 150% then speed was reduced and slow walking speed was adjusted to ensure matched distance between conditions. SS training speed was determined on the treadmill. Overground SSWS and fastest comfortable walking speed (FCWS) was assessed prior to, immediately following as well as 20, 40 and 60min post-training. Highest timepoint post-training for each session was used for analysis. Subjects also walked at treadmill SSWS and FCWS speeds found on an instrumented treadmill to collect ground-reaction force data at the same time points.

**Results:** 21 subjects complete all three sessions. 15 subjects reached IT goal of 150/50%; 6 subjects didn't reach the faster training conditions. These results focus on the individuals that accomplished the IT 150/50% goal. CT and IT treadmill training were each 20 minutes, however to match distance SS treadmill training sessions averaged 29.40±8.3 minutes (Range: 21-48). For SSWS, IT showed largest change (+0.11 m/sec) post-training compared to CT (+0.061 m/sec) and SS (+0.065 m/sec). For FCWS, IT (+0.04 m/sec) and CT (+0.05 m/sec) conditions showed the largest improvements post-training compared to SS (+0.006 m/sec). No significant differences occurred for paretic propulsion between conditions.

**Conclusions:** Faster speed (IT and CT) conditions were feasible post-stroke. The IT condition elicited significant improvement in overground SSWS acutely. CT and IT conditions elicited similar improvements in overground FCWS, however not significantly different from SS condition. Faster speed training, especially IT, showed not only bigger improvements but was more time efficient than SS. No changes occurred in paretic propulsion between conditions, therefore improvement in walking speed was due to a change in a different locomotor disturbance. There is still much research needed with this training style.

**Clinical Relevance:** The standard clinical protocol is to train at or only slightly above treadmill SSWS. This research shows that slower treadmill speeds do not provide enough stimulus to improve locomotor performance. Using overground walking speed to set training parameters is easier to implement in a clinical setting, as opposed to using aerobic capacity or heart rate reserve determined from max testing.
TITLE: Clinically significant improvements in community level ambulation using task-specific training vs. alternative rehabilitation methods in adults post-stroke

AUTHORS/INSTITUTIONS: A. Resnick, A. DeSa, T. Bowers, L. Tetreault, B. Clarke, G. Sandelli, C. Zara, J. Loeshelle, Rehabilitation and Movement Sciences, Rutgers University, Totowa, New Jersey, UNITED STATES

ABSTRACT BODY:

Purpose: The purpose of this project was to determine if there was evidence to support the use of task-specific training (functional mobility) compared to alternative rehabilitation methods (impairment based) for improving community ambulation in persons at least 3 months post-stroke.

Description: Critical appraisal framed by a PICO, using CEBM levels of evidence was performed. PubMed, MedLine, Cinahl, and PEDro databases were searched for articles published after 1/1/2000. Key words were selected based on the PICO, using AND and OR Boolean operators as follows:

Population: stroke OR adults post-stroke OR chronic stroke.

Intervention: Community Ambulation, Task Specific Training.

Comparison: Gait Training, Mobility, Strength, Balance, Impairment Training, Flexibility, Neuromuscular Reeducation.

Outcome: Gait, Mobility, Speed, Endurance, Gait Characteristics, Strength, Balance, Part-Task, Flexibility.

Inclusion criteria - persons post-stroke ≥ to three months, an RCT with outcome measures of gait speed.

Exclusion criteria - persons with TBI or other acquired brain injuries, or stroke occurring ≤ than three months prior.

Articles obtained and extracted were as follows: PubMed (251:1), CINAHL (50:2), PEDro (16:0), Medline (30:1).

Articles were extracted based on inclusion and exclusion criteria, year of publication, and use of 6MWT, 5MWT and/or 10MWT for measuring community ambulation. Community ambulation measures were selected after initial search was completed.

Summary of Use: Four articles met the inclusion criteria. Their levels of evidence varied from 1b-2b. Each study had a population with a mean age between 59 and 69, and average time post stroke was at least 3 months. There were 2 studies performed in an outpatient setting, 1 performed in an inpatient setting, and 1 performed in both inpatient and outpatient settings. When measuring gait speed, Rehab Measures notes that the MCID for the six-minute walk test is a 34.4 meter increase, and 0.16 meters per second increase for the Ten-Meter Walk test. Studies by Pang, Park, Depaul and Macko all reported a clinically significant difference for the 6MWT; Park and Depaul reported a clinically significant difference for the 10MWT. It is important to note that control groups across studies all received some form of skilled intervention. This led to within group improvements for both the task-specific training and alternative graining groups in each study. Based on our findings, task-specific training demonstrated both clinically (MCID) and statistically significant changes in gait speed, which directly correlates to improvements in community level ambulation.

Importance to Members: All of the extracted articles support that task-specific training can be used to improve gait speed and target community ambulation potential. In comparison to alternative forms of rehabilitation including impairment based and part-task interventions, task-specific training is more efficacious, highlighting the neuroplasticity principle of task specificity.
TITLE: Soleus H-reflex adaptations following upslope and downslope walking in individuals post-stroke

AUTHORS/INSTITUTIONS: J. Liang, E. Akoopie, B. Conway Kleven, T.G. Koch, Department of Physical Therapy, University of Nevada Las Vegas, Las Vegas, Nevada, UNITED STATES|Y. Lee, Department of Industrial Engineering and Engineering Management, National Tsing Hua University, Hsinchu, TAIWAN|

ABSTRACT BODY:

Purpose/Hypothesis: The excitability of the H-reflex pathway in the non-impaired nervous system could be augmented by altering the different parameters of a walking task, specifically slope. We sought to examine the adaptations in soleus H-reflex excitability and foot force control following an acute bout of upslope or downslope treadmill walking in people post-stroke.

Number of Subjects: Six individuals with chronic stroke hemiparesis and six age-similar non-neurologically impaired individuals.

Materials/Methods: Each participant was tested over 2 sessions separated by at least 7 days. For each session, participants walked at self selected walking speed on an instrumented treadmill for 20 minutes under a level and then an upslope condition, or a level and then a downslope condition, with at least one hour rest between the conditions. The vertical component of ground reaction force was used to determine the stance and swing phase of the gait cycle. Peak propulsion and braking forces were analyzed offline for the first and last minute of each walking condition to examine adaptations in foot force control. Soleus H-reflex recruitment curves and maximal soleus H reflexes were tested before and after each walking condition, in the paretic legs of the stroke group and the right legs of the control group. To ensure consistency, a control M wave preceding the maximal soleus H reflexes was kept constant across all conditions for each participant. Peak to peak amplitudes of the maximal H-reflexes and maximal M waves were measured offline and expressed as $H_{\text{max}}/M_{\text{max}}$ ratio.

Results: For both stroke and controls, peak propulsion forces during level walking were lower compared to upslope and greater compared to downslope. On the contrary, peak braking forces during level walking were greater compared upslope and lower compared to downslope. In addition, peak propulsion and braking were greater in controls than in stroke for both legs, except braking in the paretic legs. Following 20 minutes of level and downslope walking we observed increased propulsive forces in the paretic legs only and reduced $H_{\text{max}}/M_{\text{max}}$ ratio in both control and paretic legs. Following upslope walking, we observed lower $H_{\text{max}}/M_{\text{max}}$ ratio in controls but higher $H_{\text{max}}/M_{\text{max}}$ ratios in paretic legs post stroke.

Conclusions: Our observations suggest that when the biomechanics of the walking task is altered, through adjusting the slope of the walking surface, paretic legs exhibit intact foot force control for propulsion but not for braking forces. In the level and downslope condition, spinal circuits in the stroke-impaired nervous system undergo adaptations similar to the non-impaired nervous system. However, in the more challenging upslope condition, adaptations of the paretic soleus H-reflexes were impaired.

Clinical Relevance: Interacting with slope surfaces is an important aspect of community mobility. Future studies can use these findings to develop novel targeted interventions to enhance locomotor control during slope walking in people post-stroke.
Purpose/Hypothesis: The primary purpose of this study was to investigate functional DF ROM in a WB position in individuals after CVA. Because measurements of DF taken in supine do not account for WB forces or STJ movement that occur in standing, we hypothesized that standing DF measurements will differ between Habitual squat and non-STJN in supine as well as Instructed squat and STJN in supine. Additionally, this study aimed to determine the reliability of a 2D motion analysis system in measurements of DF in post-CVA subjects. We hypothesized that DF measurements taken using a standard goniometer and the Simi Move iPad application will be correlated with reliability between examiners.

Number of Subjects: We recruited 7 subjects with chronic CVA from our pro-bono neurology clinic that could squat with no more than contact guard assist.

Materials/Methods: Ankle DF was measured in: WB in a habitual squat; WB in an instructed squat (knee progressed over the 2nd metatarsal when squatting in an attempt to keep STJN); and NWB supine position. Peak ankle dorsiflexion was captured for all conditions in real time by the by an examiner using the simimove app, followed by another examiner using a standard goniometer.

Results: Paired t-tests were used to determine if differences existed between DF measurements in supine and squat. An ICC model 2 measured reliability between DF measurements obtained through goniometry and the Simi Move iPad application. There was no significant difference between habitual or instructed squat conditions, therefore habitual squat was used for the remaining analyses. There was significantly larger dorsiflexion ROM measured in habitual squat compared to supine non-STJN or STJN conditions (p<.05). There was an excellent inter-rater reliability for simi-move data for habitual and instructed squat conditions (ICC = 0.99). There was good inter-rater reliability between the supine STJN (ICC=0.77) and supine non-STJN (ICC=0.74) conditions. Simimove correlated strongly with goniometry for supine STJN and non-STJN (p<.01), and habitual squat (p<.05) conditions.

Conclusions: The results of this study support measuring DF in squatting rather than supine to predict use of DF in function in individuals after CVA. In addition, this study provided preliminary evidence in support of the use of the Simi Move iPad application to measure functional ADF in the post-stroke population. Further research is needed to support our study results.

Clinical Relevance: Because of the increased torque at the ankle and the difficulty in controlling STJN during WB it is not surprising that the DF measurements were greater in the functional standing positions compared to when the examiner passively applied a dorsiflexion torque at the ankle. Common practice amongst physical therapists working with the chronic stroke population is to assess DF range of motion in supine This could lead to an inaccurate assessment of a patient’s functional range of motion. Initial results indicate that Simimove is a valid and reliable substitute for goniometry, and it is a more feasible method of measuring functional ROM.
 TITLE: Complexity and fractal dynamics of gait in a 46 year old man with chronic inflammatory demyelinating polyneuropathy (CIDP): A case report

AUTHORS/INSTITUTIONS: J.H. Hollman, B.A. Beckman, Physical Therapy, Mayo Clinic, Rochester, Minnesota, UNITED STATES

ABSTRACT BODY:

Background & Purpose: CIDP is an autoimmune disorder characterized by progressive neuromuscular weakness. With advances in immunotherapy (eg, intravenous immunoglobulin IVIG), mortality associated with CIDP is low, though morbidity is prevalent; 7% of patients use wheelchairs for mobility and 28% require assistive devices to walk. Depending on one's deficits, ankle foot orthoses (AFO) may normalize gait and reduce energy costs of walking. Their effects may be examined with linear or nonlinear measures that characterize gait, but nonlinear measures may yield more insight about walking capacity than traditional linear measures. The aim of this report was to describe linear and nonlinear gait characteristics in a patient with CIDP who used an AFO to walk community distances.

Case Description: A 46 year old man with a 7 year history of CIDP received weekly IVIG infusions. Strength deficits were present in right lower limb muscles innervated at the L5-S2 root levels (Grade 1 ankle plantarflexors, Grade 2 dorsiflexors, Grade 4 knee flexors and hip extensors/abductors). Walking was difficult, with foot drop occurring after approximately 2 city blocks. He was provided an energy-return, posterior spring carbon fiber AFO (Bio-Mechanical Composites, Inc). He completed two 6-minute walk tests, first without and then with the AFO, while wearing inertial sensors (APDM, Inc). Linear gait parameters (walking speed) and nonlinear estimates of stride time complexity and fractal dynamics were measured.

Outcomes: The patient's mean walking speed was 1.48 m/s (11.6% CV) without the AFO and 1.63 m/s (4.6% CV) with it. Regarding stride time complexity, sample entropy was 1.386 without the AFO and 2.094 with it. With fractal dynamics, the Hurst exponent was .53 without the AFO and .70 with it.

Discussion: The deficit in walking speed without the AFO was .15 m/s. While that deficit exceeds the minimum detectable change for walking speed, walking at 1.48 m/s would not typically be interpreted as pathological. Nonlinear analyses, however, present a different conclusion. Physiological systems with lower sample entropy are less complex, less adaptable. While variability was greater when walking without (11.6% CV) than with an AFO (4.6% CV), the stride time signal was 40% less complex, suggesting a less adaptable, more pathological locomotor system. Fractal analyses provide similar findings. Hurst exponents of .50 reflect randomness among serial data. In contrast, Hurst exponents departing from .50 reflect systems with long range correlations that are interpreted as outcomes of complex, healthy dynamical systems. Breakdowns in the fractal structure of stride fluctuations are a signal of pathological gait. This patient's fractal index without an AFO (.53) represents an outcome of a pathological system. His fractal index with the AFO (.70) approached that of a more healthy system. Nonlinear analyses may yield more insight about one's ability to walk successfully with an AFO than is provided with traditional linear gait measures.

A Case Study: Physical Therapy Interventions for an Atypical Guillain-Barre Syndrome Recovery Pattern

D. Sinay, Gouverneur Health, New York University, Brooklyn, New York, UNITED STATES

Background & Purpose: Guillain Barre Syndrome (GBS), typically categorized as an acute inflammatory demyelinating polyneuropathy (AIDP), causes the immune system to attack the peripheral nerve myelin, resulting in progressive polyradiculoneuropathy. Symptoms may include symmetric motor paralysis, and varying sensory and autonomic impairments. Typical progression of GBS results in distal to proximal recovery. This case study describes a patient with an atypical GBS recovery pattern, novel treatment, and outcomes.

Case Description: A 43-year-old male was admitted to the emergency department with opthomoplegia, diplopia, left facial droop, myalgia, and bilateral upper extremity (UE) and lower extremity (LE) paralysis. The initial misdiagnosis of myesthenia gravis (MG) with decline in symptoms due to MG medication was changed to GBS after positive lumbar puncture. The patient presented to subacute rehabilitation (SR) with UE, LE and trunk paralysis. Initial evaluation revealed trace muscle contractions across all UE and LE joints, requiring 90% to 100% lifting assistance for bed mobility and transfers. Physical therapy (PT) goals included 50% lifting assistance for all bed mobility and transfers. No independent ambulation goals were initially set.

Outcomes: Outcomes include independence with bed mobility and slide board transfers, and strength improvements proximal to distal, atypical in GBS recovery. Daily treatment plan was comprised of evolving interventions based on a unique recovery pattern. Interventions included Proprioceptive Neuromuscular Facilitation (PNF) to pelvic girdle, active assist range of motion (ROM) to all extremities with/without electrical stimulation (ES), bed mobility training, balance/postural training, and slide board transfer training. After 16 weeks the patient displayed improved trunk control and proximal LE muscle initiation and began standing/ambulation training in Sara Stander ™ /LiteGait™. The patient currently tolerates 40 min in supported standing and ambulates 100 ft in LiteGait™.

Discussion: There is limited research to provide accurate prognosis or evidence-based (EB) interventions for GBS cases with atypical presentations. The recovery period and pattern seen in this case are unique. The majority of EB interventions are based on a four week nadir of symptoms with distal to proximal recovery. However, due to daily change in prognosis, an EB approach to treatment for atypical GBS recovery was difficult to identify, yet was used to inform a novel plan of care. The uncharacteristic recovery pattern required a synthesis of EB interventions to effectively restore function. Treatment including ROM exercises with concurrent ES to proximal LE muscles, and PNF to the hip girdle were key to his recovery. This introduces a novel approach for atypical GBS presentation. The successful outcomes described suggest that this approach may be implemented for similar cases.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Exercise Based Intervention for Adults with Parkinson's Disease to Improve Functional Outcome Measures in Ambulation and Balance

C. Voltmer, Touro College, Bellmore, New York, UNITED STATES

Purpose/Hypothesis: Intensive outpatient physical therapy regimens using large amplitude movements (LAM) have been reported to be effective in improving gait and balance deficits associated with Parkinson's Disease (PD) (Elbersbach, et al., 2012). However, this regimen is often unrealistic for a PD population to adhere to for practical purposes. The current quasi-experimental study examines the efficacy of a protocol using a combined LAM over a more traditional scheduling paradigm.

Number of Subjects: Subjects with PD were recruited via convenience sampling (N=27) from a neurologic outpatient PT facility.

Materials/Methods: Patients underwent a 4 week intervention combining traditional PT and LAM exercises. Pre and post intervention assessments included Timed Up and Go (TUG), Mini-BESTest or Berg balance scale, and measurements of gait characteristics (GAITrite™). Patients were classified using Hoehn and Yahr (H&Y) stages to discern results based on disease severity.

Results: Pooled data (N=27) showed significant improvement from pre and post tests (p <.05) for TUG, MiniBEST, symmetry index, velocity, and right/left step length. H&Y stage 3 (n=18) specifically, showed significance from pre and post tests (p <.05) for TUG, MiniBEST, velocity, and right/left step length. There was a clinically relevant (MCID and MDC) improvement in the Mini-BESTest (3/7) and TUG (5/18).

Conclusions: The current study suggests implementation of combined traditional PT and LAM in a more typical therapy scheduling paradigm can elicit improvement in individuals with PD, particularly with more advanced stages.

Clinical Relevance: Our study suggests effective treatment of PD can be accomplished through a combination of LAM and more traditional methods under a less rigorous treatment schedule than has been previously reported.
Purpose/Hypothesis: Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) has been utilized to establish baseline neuro-cognitive abilities and to provide data for return to play (RTP) decisions after a concussion. However, while it provides valuable information, ImPACT is not a comprehensive measure of the numerous dynamic requirements for safe athletic play. This pilot study incorporated the Psychomotor Vigilance Task (PVT) to assess baseline auditory reaction time in high school male football players. Current PVT studies have established auditory reaction time (RT) normative values regarding: mean reaction time, frequency of lapses, optimum response time (fastest 10 percent), and false response frequency for ages 6-11 and 20-40; however, norms have not been established for high school male athletes. The purpose of this study was to establish normative data on the PVT test in male high school athletes ages 15-18.

Number of Subjects: Preseason data for the PVT test as well as ImPACT RT (visual) data have been collected on male high school football players from three different high schools. Demographics are as follows: 10th grade (n=50), 11th grade (n=41), and 12th grade (n=40); Caucasian (n=66), African American (n=62), and other (n=3).

Materials/Methods: The PVT is a test of behavioral alertness designed to evaluate the ability to sustain attention and respond in a timely manner to salient signals. The PVT measures simple RT to a 1 KHz auditory stimulus of 90 dB SPL over 10 minutes. The inter-stimulus interval varies from 2-10 sec. The number of total errors and false starts were used to determine a successful trial. We examined the mean and the standard deviation of reaction time as experimental variables in addition to multiple performance parameters that can be derived from each PVT trial for each athlete.

Results: Normative percentiles have been determined for each parameter (mean RT, fastest 10 percent, reciprocal mean reaction time). Additional data analysis was completed to determine percentiles for the entire group. Ranges of the mean RT were from 160.04-347.66 ms. Mean RT for 10th graders was 240.63 ms (SD 106.18), 11th grade 259.68 ms (SD 126.30) and 12th grade 213.33 ms (SD 78.09). The range of false starts were from 0-11 and the range of total errors were from 0-12. The fastest RT ranged from 119.3-221.9 ms.

Conclusions: The PVT data collected for the male football player from 15-18 years old suggests that this age group demonstrated the fastest mean RT compared with the published data through 11 year old and also compared with the published data on adults. Additional data analysis is ongoing to examine the correlation between auditory RT and visual RT in the same athlete.

Clinical Relevance: The clinical significance of this study is to establish auditory RT norms of the high school male athlete as well as comparisons between auditory and visual RT. Future studies can utilize auditory RT in concussed athletes compared to the normative values as part of the rehabilitation process and allow for additional assessment information to make RTP decisions.
**Title:** The Impact of a Student Assisted Workout Program (SAWP) Amongst College Students with Physical and Intellectual Disabilities: A Case Series

**Authors/Institutions:** P. Pabian, University of Central Florida, Orlando, Florida, UNITED STATES| J. Tucker, C. Stocker, R. Diana, R. Gandola, Health Professions, University of Central Florida, Orlando, Florida, UNITED STATES

**Abstract Body:**

**Background & Purpose:** The University of Central Florida’s Student Assisted Workout Program (SAWP) was created to facilitate physical activity and improve healthy behaviors for students with disabilities. Each student enrolled in the SAWP receives one-on-one, individualized exercise training from a student in the physical therapy program. The SAWP is offered to students with disabilities at no cost. Individuals with disabilities are at greater risk for physical inactivity and obesity; therefore, it is important to support physical activity and health behaviors for these individuals. The purpose of this study was to examine the impact of the SAWP on general health, functional mobility, quality of life, self-esteem, and self-efficacy among participants who have physical and/or intellectual disabilities.

**Case Description:** This retrospective case series analysis of 4 participants. All participants were enrolled at the university and voluntarily enrolled in the SAWP. Participants had a range of conditions, two of whom had Down Syndrome, one Dwarfism, and one Cerebral Palsy. Outcomes were assessed when participants were enrolled in the SAWP and then reassessed at 6-8 week intervals over the 16-week semester. Measures included vital signs (resting heart rate, blood pressure, and respirations), the Neuro-QOL questionnaire, General Self-Efficacy Scale (GSE), Rosenberg Self-Esteem Scale (RSE), 6 Minute Walk Test (6MW), 3-rep max (3RM) chest press, 3-rep max (3RM) leg press, and Functional Reach Test.

**Outcomes:** A review of outcome measures over the 16 week period revealed improvements in general health with decreased BMI scores noted in three of the four participants. All participants demonstrated improvements in the 6MW with two participants surpassing established MDC for all diagnoses. In addition, all participants demonstrated improvements in strength on 3 RM in both upper and lower extremities. Meaningful changes were not noted for overall score of the Neuro-QOL; however, scores did improve in areas of fatigue and sleep quality among all participants. The Rosenberg Self-Esteem Scale score decreased by as much as 5 points in one participant in comparison to the other participants who improved or declined by 2 points or less. Three of the four participants showed improvements on the General Self Efficacy Scale with the exception of one participant who improved by one point.

**Discussion:** These preliminary findings demonstrate potential benefits of the SAWP. All participants demonstrated strength and endurance improvements while reporting decreases in fatigue and improvement in sleep quality. Fatigue and sleep quality undoubtedly impact the academic performance of all college students including those with disabilities. As anticipated, the variability in the participants' specific impairments and abilities and challenges with consistent attendance may have influenced the outcome measures and impacted overall impact of the program.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Background & Purpose: Spinal cord injuries (SCI) often beget radical effects on the body's sensory, motor, and autonomic systems, possibly leading to further functional disability, including loss of ambulatory abilities. Current literature lacks evidence presenting a systematic progression of interventions facilitating a return of ambulation post SCI. The purpose of this retrospective case report is to describe and analyze a systematic treatment progression utilized for an individual with a SCI with long term goals to reestablish functional ambulation.

Case Description: An 18 year old, female patient clinically diagnosed with an AIS D T10 SCI secondary to a gunshot wound. The patient underwent a 16 day stay in an inpatient rehabilitation facility. At the physical therapy (PT) initial evaluation, the patient presented with bilateral lower extremity weakness, sensory loss, poor proprioception, and high fall risk based on a Berg Balance Scale. The Functional Independent Measure (FIM) indicated deficits during transfers, ambulation, and stair negotiation. Primary interventions focused on body weight support treadmill training (BWSTT) and over-ground gait training. BWSTT and over-ground training were systematically shaped in order to progress the patient to a return to functional ambulation.

Outcomes: Significant increases of strength, balance, sensation, and proprioception were noted by discharge. Berg Balance Scale score improved 13 points (MDC=8.1) from 39/56 to 52/56. FIM scores increased 45 points (MCID=17) from 39/91 to 84/91. BWSTT initiated with ambulating at 0.3mph with moderate body weight support, improved to jogging at 3.7mph with minimal body weight support for stability and safety at discharge. All locomotor items on the FIM were completed at a modified independent (MODI) level by discharge. The patient achieved/exceeded all established long term goals and was deemed safe for discharge home four days early, without need of an assistive device. Upon discharge, the patient was referred to outpatient physical therapy for continue progression of functional independence and strengthening to increase participation and aid in community reintegration.

Discussion: The patient experienced a successful bout of rehabilitation, attaining all personal goals and long term therapy goals. Functionally, she demonstrated the ability to ambulate at a MODI level and was deemed safe to return home without the need of an assistive device. Gait progressions followed a paradigm including facilitating proper mechanics, increasing speeds and duration, decreasing body weight support, decreasing upper extremity support, varying direction, and finally, having the patient react to changing environments. This model focuses on recovery rather than compensation. While this model for physical therapy treatment was successful for this particular patient's return to functional ambulation, it is a case report and therefore is not generalizable to all individuals with SCIs.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Paretic hip muscle activation during mid step

AUTHORS/INSTITUTIONS: K. Coombes, D. Fredricks, Department of Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES; R. López-Rosado, A.C. Dragunas, Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Stroke is a leading cause of disability and fourth cause of death for American adults. Common abnormal coupling patterns post-stroke include hip extension, adduction and knee extension; or hip flexion, abduction and knee flexion. These coupling patterns make it challenging for individuals post-stroke to perform functional activities, such as a step-up task. The purpose of this study was to quantify hip musculature activation of the non-paretic (NP) and paretic (P) lower limbs during landing (mid step). We hypothesized that Individuals post-stroke would generate an increased activation of paretic hip extensors, adductors and knee extensors of the stepping limb at mid step.

Number of Subjects: Subjects were community ambulators, able to step up and down a 4” high step, and diagnosed with a unilateral brain lesion (>1 year); N=10. Subjects’ balance perception was assessed by the Activity Balance Confidence (ABC) Scale (x=84%). Lower Extremity (LE) functional movement was determined by the LE Fugl-Meyer (x=20.4).

Materials/Methods: Subjects were secured in an overhead safety harness and instructed to stand in a comfortable position. They performed 24 randomized forward step-up trials; 12 leading with P limb and 12 leading with NP. Electromyographic (EMG) input from Gluteus Maximus (GMax), Gluteus Medius (GMed), Adductor Longus (AddL), and Rectus Femoris (RecFem) was collected for both the stepping and stance limbs. Maximum EMG value within the same limb and muscle was used to normalize EMG data. Hip kinematics and kinetics, as well as age-matched control data were also collected as part of a larger study. Mid step point was defined as the point in the gait cycle when the stepping limb is supporting full body weight and the foot of the trailing limb is off the floor.

Results: Activation of selected hip musculature was calculated for both P and NP stepping limbs. There were no significant differences between limbs during stepping for hip muscle activation. Due to the small sample size, the non-parametric Wilcoxon signed rank tests were used to compare the P and NP groups. GMed showed the greatest variability and the largest difference between P and NP limbs. Muscle activation and its associated timing varied during the entire step task.

Conclusions: GMax symmetrical muscle activation suggests similar activation pattern in both P and NP limbs at mid step. GMed muscle activation was increased in the stepping limb. There might be a difference in timing of hip musculature activation between the P and NP stepping limbs. No significant difference was found at a p=0.05 level, probably due to the lack of power as this was a pilot study.

Clinical Relevance: Increased paretic GMed muscle activation combined with delayed timing may differ from the muscle activation observed in non-paretic limb during a step up task for individuals with chronic post-stroke.
TITLE: The recommended treadmill training parameters for chronic stroke patients: a systematic review.

AUTHORS/INSTITUTIONS: S.M. Obaidat, Physical Therapy and Rehabilitation Science, KUMC, Kansas City, Kansas, UNITED STATES|M.N. Oligbo, W. Liu, Physical Therapy & Rehabilitation Science, University of Kansas Medical Center, Kansas City, Kansas, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Improving ambulation in adults with neurological disabilities has long been a major goal of physical therapy. Treadmill training (TMT) has been used frequently in stroke rehabilitation. So far, TMT protocols are widely variable. Few previous reviews have compared settings of TMT protocols. In this review, we examined variations in various TMT protocols and possible connections to specific outcomes.

Number of Subjects: N/A

Materials/Methods: We reviewed articles of randomized clinical trials for patients with chronic stroke (6 months onset), in which TMT constituted at least 50% of their rehabilitation intervention. Functional outcomes include cardiovascular capacity, strength, balance, and ambulation. Data of participant's functional level; protocol length, session duration and intensity was extracted. The studies were evaluated according to PEDro quality scale (0-11 score, where 0 is lowest quality).

Results: Ten articles were included in this review. The sample size ranged from 15 to 60 (Total n= 382), with mean ages between 45 to 75 years and time after stroke from 6.6 to 27 months. TMT length ranged from 2-18 weeks, for about 20-60 minutes in each session. Three studies used the maximal TMT speed of 0.9 – 1.4 m/s and reported positive results only in cardiovascular capacity; while seven studies reported positive outcomes in all functions using the maximal TMT speed of 1.5-1.9 m/s. Four articles showed improvement in only cardiovascular capacity with training activities lasting for 2-6 weeks, while 6 articles showed improvements in all functional outcomes using training duration > 6 weeks.

Conclusions: TMT training using high speed with high frequency and long training period may lead to improvements in multiple outcomes. With less aggressive setting, TMT may still improve cardiovascular function in stroke survivors.

Clinical Relevance: This review reported high variability in TMT training protocols and a trend in favor of high intensity TMT training. This review can help clinicians to setup training protocols based on standard guidelines and functional needs. Further work is needed to confirm the specificity of more TMT protocols.
TITLE: The Reliability of a Self-Report Questionnaire About Lifetime Physical Activity Levels in People with Parkinson's Disease

AUTHORS/INSTITUTIONS: K.N. Johnson, J. Zorn, D. Salgo, M.R. Landers, University of Nevada, Las Vegas, Las Vegas, Nevada, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: The purpose was to investigate the reliability of a self-report questionnaire about lifetime physical activity levels in people with Parkinson's disease (PD). In addition to mounting evidence that vigorous aerobic exercise may have a neuroprotective effect in PD, several large epidemiological studies have shown a relationship between physical activity in earlier life and PD. However, because prospective designs investigating physical activity and subsequent PD diagnosis require an impractical length and number of participants, self-report questionnaires are necessary to better understand the physical activity-PD relationship and other factors associated with it. As part of a larger ongoing study, a questionnaire was developed, the Lifetime Physical Activity Questionnaire (LPAQ), to measure physical activity levels throughout one's lifespan.

Number of Subjects: 15

Materials/Methods: Participants answered the LPAQ twice separated by at least one week. The LPAQ required participants to report their typical number of hours per week spent in moderate activity, vigorous activity, walking, and sitting for each of the following time periods: teens, 20-29 years of age, 30-39 years of age, 40-49 years of age, 50-59 years of age, during the 5 years preceding PD diagnosis, and during the time since PD diagnosis. An Intraclass Correlation Coefficient (ICC) model 3 was calculated for each time period and for each level of activity.

Results: ICCs for moderate and vigorous physical activity recollection ranged from .765 to .906 for all of the time points between 20-29 years to 5 years before diagnosis. ICCs for walking and sitting were much more variable for the same time periods and ranged from .285 to .815. ICCs for the teen years were low: .001 for moderate activity, .549 for vigorous, .070 for walking, and .489 for sitting. Likewise, ICCs were generally low for the time since diagnosis (all below .248) except for vigorous activity which was .911.

Conclusions: In general, the reliability of the questionnaire was good for recollection of moderate and vigorous physical activity from the 20-29 range to 5 years before diagnosis; however, the recollection of teen and since diagnosis physical activity levels was generally poor. Reliability of the LPAQ was best for recollection of vigorous physical activity for every time point which suggests that vigorous activity may be easier to recollect.

Clinical Relevance: The LPAQ is reliable for the self-report of moderate physical activity from 20-29 through 5 years preceding diagnosis and for vigorous physical activity for all time points except for the teen years. The utility of the LPAQ for the teen years and for walking and sitting is not recommended due to poor reliability.
The impact of a motivational task on motor learning during reactive balance in an individual with cerebellar deficits: A case report.

K. Hoover, J. DeLyser, J. Mowder-Tinney, D. Towle, Nazareth College, Rochester, New York, UNITED STATES

Background & Purpose: The cerebellum is critical for the execution of appropriate extremity movements and regulation of balance. Due to the degenerative effect on motor learning in cerebellar disease, the benefits of specific physical therapy interventions remain uncertain. Although maximally challenging and intensive balance training has shown to be effective, evidence based interventions are still limited. Other populations with similar balance deficits have shown positive outcomes utilizing reactive balance and task oriented training with altered sensory input. Therefore, incorporating these types of interventions for individuals with cerebellar disease should be investigated. The purpose of this case report was to utilize a motivational task, emphasizing somatosensory awareness and challenging reactive balance training, to improve functional outcomes.

Case Description: The patient is a 35-year-old male, six years status post TBI and medullablastoma resection causing cerebellar ataxia. Major symptoms include decreased balance leading to decreased self-awareness, impaired motor planning, decreased coordination, and general deconditioning. The patient ambulates independently without a device but uses a wide BOS and marked deviations. Upon returning to therapy after a six month break, he reported a decline in endurance and balance. The patient received a one-hour session of therapy each week, for 8 weeks. Initial treatments focused on coordination and motor planning. Mid-way through therapy, interventions transitioned to focus on somatosensory awareness within a reactive balance program to simulate carrying his 7-month old nephew comfortably and safely.

Outcomes: The following outcome measures were used: TUG, Four Square Step Test, FGA, and SARA. Improvements were noted in all measures, with the FGA achieving the MDC. The following observations were made when the intervention focus switched to a motivational task: increased self-awareness and ability to initiate appropriate stepping responses before a loss of balance, quality of gait including speed consistency and reduced deviations, and patient reported increased confidence in balance and stability.

Discussion: Utilizing a motivational component in conjunction with a somatosensory based reactive balance training program may be beneficial in people with cerebellar deficits. The patient’s improvements on the TUG, FGA, and self-reported balance are consistent with other research focused on balance control. Limitations in this case report include a single subject design and frequency of treatment. It was difficult to isolate if the task specific and motivating activity, the reactive balance focus, or the emphasis on somatosensory retraining had the greatest impact. However, the motivational goal of carrying a child appeared critical, reinforcing the importance of integrating social, cognitive, and affective components into treatments. Future studies should continue to investigate the importance of focusing on a motivational task with this population.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
7. Lewthwaite R, Wulf G. Grand challenge for movement science and sport psychology: embracing the social-
Proficient Exoskeleton Use with Significant Musculoskeletal Limitations: What are the recurring themes of successful individuals?

M. Kallins, P.R. Geigle, Rehabilitation Research, University Maryland, West Chester, Pennsylvania, UNITED STATES
W.H. Scott, Neurology, University of Maryland, Baltimore, Maryland, UNITED STATES

Background & Purpose: Exoskeleton devices provide opportunities for increased upright mobility for individuals experiencing limited gait activity. Specific criteria guide optimal candidate selection for exoskeleton use. We identified outliers who given an exoskeleton trial achieved independence with home (personal) exoskeleton units. Utilizing qualitative and quantitative analyses we identified consistent recurring themes leading to successful exoskeleton use.

Case Description: A non-ambulatory 32-year-old woman with a T12 American Spinal Injury Association Impairment Scale (AIS) A spinal cord injury (SCI) and transfemoral amputation from a motor vehicle accident at age 18 expressed a desire for functional ambulation.

A non-ambulatory 66 year old man with a T5 AIS level A injury and an unstable left knee due to complete rupture of the left ACL, PCL, MCL, and LCL following a motorcycle accident also desired upright mobility via an exoskeleton for professional and social use.

Based on existing exoskeleton training guidelines both individuals demonstrated attributes indicating potential ability to master exoskeleton ambulation. But both also had musculoskeletal issues making them unlikely candidates for exoskeleton training. We rigorously examined all data attempting to identify common features displayed by individuals who demonstrated successful exoskeleton mastery in 25-30 sessions.

Outcomes: Exoskeleton walker 1: achieved independent ambulation with a personal unit as well as improvements in pain, endurance, and reported self-esteem. Provided safety criteria are met, robotic exoskeleton gait training is possible for a person with combined paraplegia and transfemoral amputation.

Exoskeleton walker 2: demonstrated proficiency utilizing a personal unit in his medical practice. He reported improvements in trunk alignment/control, strength, endurance, and professional/social interactions.

With the basic physical guidelines met we identified the following criteria impacting the ability to achieve exoskeleton proficiency:
1) motivation (measured by adherence to scheduled appointments); 2) active participation in the community prior to exoskeleton training via qualitative data obtained from electronic medical record (EMR); 3) baseline fitness levels including cardiopulmonary data from physical therapy evaluation and qualitative data from EMR; 4) existing family, peer, community support measured by qualitative assessment using constant comparative analyses.

Discussion: Clinically it is difficult to determine exactly who will demonstrate success of any given intervention. Clear standardized measurements exist for strength, endurance, range of motion, transfer abilities. But when selecting a specific intervention path for a given client, we must also include personal traits and experiences which are more difficult to measure with standardized tools: clinical decision making: motivation, community activity, fitness levels, and family, peer, community support.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: The effects of large amplitude movement training in an unweighted harness system on functional outcome measures and fear of falling in individuals with Parkinson’s Disease.

AUTHORS/INSTITUTIONS: J. Mowder-Tinney, G. Camilleri, J. Horan, G. King, B. Lang, B. Partridge, S. Parton, Nazareth College, Rochester, New York, UNITED STATES| K. Pullano, A. Newton, Lifetime Care, Rochester, New York, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Parkinson’s Disease (PD) typically results in impaired functional mobility and increased risk for falls which affects ~8 million people worldwide. Although body weight supported harness systems\(^1,2\) and large amplitude movement training\(^3,4\) have separately shown improvement in function in those with PD, there is little research involving a combination of these therapies. In addition, few studies include an assessment of fear of falling although there is a correlation between increased fear of falling and poorer results on functional outcome measures.\(^5\) The purpose of this pilot study was to bridge this gap in the literature and assess the effects of progressive large amplitude movements with and without utilization of an unweighted harness system on functional outcome measures and fear of falling.

Number of Subjects: Eight participants (six male, two female) diagnosed with PD with an average age of 75 years. Due to attrition data was collected on seven participants.

Materials/Methods: Of the eight participants, four were randomly placed in the harness system and four were placed in a matched control group (no harness). Interventions took place twice a week for five weeks for 50 minutes each session. Each group performed the same exercises focusing on large amplitude movements with progressive challenges including but not limited to sit to stands, step ups, turns, and reactive balance. Participants in the harness group performed interventions starting at 20% unweighted. Pre and post-test measures included 10MWT, TUG, 6MWT, ABC scale, and cadence.

Results: Subjects in the harness group showed a mean improvement in the 10MWT, 6MWT, and ABC scale; while the control group showed a mean improvement in the 10MWT and 6MWT with a mean decrease in the ABC scale. Overall, improvement in the harness group was greater than those in the control group with no clinically significant changes in either group for the TUG or cadence.

Conclusions: The application of large amplitude movements within an unweighted harness system showed greater improvement than large amplitude movements alone for the 6 MWT and ABC scale. These results differ from a meta analysis,\(^6\) which found no significant difference in ABC scale scores between an exercise and control group for people with PD despite exploring various interventions. Post-test ABC scale results suggest the use of an unweighted harness system may create an environment that allows greater confidence while performing large amplitude movements. Further research is needed to explore the benefit of a harness system for people with PD. Limitations of the current study are the small sample size, baseline differences between groups, and the fluctuation of symptoms.

Clinical Relevance: Using an unweighted harness system in conjunction with large amplitude movements may help to reduce fear of falling in individuals with Parkinson’s Disease and allow utilization of more challenging activities.
**Title:** Diagnostic Differences in Improvement during Inpatient Rehabilitation

**Authors/Institutions:** A. Andrews, Physical Therapy Education, Elon University, Elon, North Carolina, UNITED STATES | A. Middleton, Rehabilitation Sciences, University of Texas Medical Branch, Galveston, Texas, UNITED STATES

**Abstract Body:**

**Purpose/Hypothesis:** To compare the improvement experienced by patients with the following incident diagnoses: Guillain-Barré Syndrome (GBS), Multiple Sclerosis (MS), Parkinson Disease (PD), and Stroke following inpatient rehabilitation in the United States.

**Number of Subjects:** Patients admitted to inpatient rehabilitation hospitals with an incident diagnosis of: GBS (n=1079), MS (n=1438), PD (n=11,834), or stroke (n=131,313). Patients were excluded if they were transferred to an acute hospital or died, were discharged against medical advice, had a length of stay less than 3 days, or were younger than 65 years of age.

**Materials/Methods:** Improvement in Functional Independence Measure® (FIM) scores on self-care, mobility, and cognition during inpatient rehabilitation. We estimated percent improvement from a multilevel model adjusted for patients’ age, sex, race/ethnicity, comorbidity count, impairment group (GBS, PD, MS, and stroke), and admission score on the functional domain of interest.

**Results:** Patients receiving rehabilitation for GBS demonstrated the greatest percent improvement across all three domains (self-care: 84.1%, 95% CI: 81.1-87.1%; mobility: 144%, 95% CI 139.6-148.5%; cognition: 51.7%, 95% CI: 49.2-54.2%). On the self-care and mobility domains, patients receiving rehabilitation for MS demonstrated the lowest percent improvement (self-care: 49.5%, 95% CI: 46.8-52.2%; mobility: 84.9%, 95% CI: 81.0-88.9%), whereas on the cognition domain patients with PD demonstrated the lowest percent improvement (34.0%, 95% CI: 33.0-35.0%).

**Conclusions:** Patients with GBS experienced greater improvements in all three functional domains than patients in any other group. Patients with MS and PD experienced more modest improvements compared to those who sustained GBS or stroke.

**Clinical Relevance:** A patient's prognosis, goals, and discharge recommendations should be adjusted according to the patient's primary diagnosis.
ABSTRACT BODY:

Background & Purpose: Wallenberg’s Syndrome (WS) or lateral medullary syndrome is a neurological condition resulting from occlusion or dissection of the vertebral or posterior inferior cerebellar artery thus affecting the vestibular nuclei located within the brainstem. Patients with WS may present with vertigo, oculor tilt reaction, skew deviation, ipsiversive deviation of subjective visual vertical, hemisensory disturbances (ipsilateral face, contralateral body), ipsilateral Horner’s syndrome, lateropulsion and cerebellar signs.

Due to the rarity of WS there is a lack of research supporting the efficacy of rehabilitation on patients with this disorder. There is research to support central compensation of oculomotor impairments over time; however, commonly patients are left with functional impairments impacting safety and participation in functional activities. The purpose of this case series is to demonstrate the effectiveness of outpatient vestibular rehabilitation in patients with WS.

Case Description: Three patients were included in this case series, with diagnosis of WS in the setting of ischemic stroke or dissection. Patients presented to outpatient vestibular therapy clinic between 2-3 months post stroke. Presentation at initial evaluation included lateropulsion, diplopia, vertigo, and ataxia in all 3 patients. There was also noted skew deviation, ocular tilt and deviation of visual vertical in at least 2 patients. On evaluation, impairments were noted in Romberg stance eyes open and closed, gait was ataxic with wide base of support and scores on the Functional Gait Assessment (FGA) indicated risk for falls. Patients also reported high Dizziness Handicap Inventory (DHI) scores and low Activities-Specific Balance Confidence Scale (ABC) scores.

Physical Therapy intervention consisted of standard vestibular rehab exercises including habituation and adaptation tasks such as ambulation with head turns, gaze stabilization, and sensory reorganization training. As patients are unable to rely on visual feedback due to aforementioned visual impairments, proprioceptive feedback was emphasized to assist in determining midline orientation during static and dynamic balance and gait tasks. Standard vestibular exercises were performed with emphasis on weight shift to the opposite side of lateropulsion, to promote a counteractive response and improved midline orientation.

Outcomes: All patients demonstrated improvements in gait pattern, static standing balance, FGA, DHI, and ABC. Two patients’ subjective visual vertical improved as objectively measured via the bucket test. They also reported decreased if not total resolution of vertigo and all patients returned to work.

Discussion: This case series demonstrates significant improvements in return to functional activities, decreased risk for falls and improved quality of life. These findings support the use of an outpatient vestibular rehabilitation based program in the management of patients following WS.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Efficacy of cryotherapy on spasticity in people with neurological disorders: A systematic review

W. Kennebeck, K. Gaston, Y. Tran, H. Zarich, R. Xia, Doctor of Physical Therapy, University of Saint Mary, Leavenworth, Kansas, UNITED STATES

Purpose/Hypothesis: Spasticity is characterized by velocity-dependent increase in resistance of a muscle or muscle group to passive stretch. It is one of the primary neurologic impairments associated with a number of neurological disorders, including but not limited to, stroke, multiple sclerosis, and cerebral palsy. Spasticity contributes to deficits in function and overall mobility and is closely related to motor recovery and neuroplasticity post-stroke. Spasticity is currently managed by a range of regimes including medication, surgery, and modalities such as cryotherapy. There has been no systematic examination of the effectiveness of cryotherapy in reducing spasticity. The purpose of this systematic review was to evaluate the efficacy of cryotherapy modality in the management of spasticity.

Materials/Methods: A systematic search of databases CINAHL Complete, Google Scholar, PubMed, and PEDro was performed utilizing the search terms: “spasticity” OR “hypertonia” AND “cryotherapy” OR “cold” with a limitation to articles published in and after 2008. The criteria for selecting articles to be included in this review were: 1) having a score of at least 5 out of 10 on the PEDro scale employed to assess the methodologic rigor of individual studies; 2) including subjects who had spasticity as a result of a neurological disorder; 3) administration of cooling therapy as an intervention; 4) measurement of spasticity as one of the outcomes.

Results: Four randomized controlled trials were included in this systematic review. Three studies consistently demonstrated statistically significant reductions in spasticity following cryotherapy. Abd El-Maksoud et al. showed significant difference in post-treatment modified Ashworth scale scores in children with cerebral palsy, in favor of cryotherapy (P = 0.0143). Sipavicene et al. showed significant reduction of the lower limb spasticity in children with cerebral palsy (P < 0.05). Further, Avilala et al. demonstrated statistically significant improvement in plantar flexor spasticity using cryostretches compared to hold-relax techniques in subjects with hemiplegia (P = 0.001). In addition, cryotherapy has been shown to induce significantly delays in the muscular responses (M wave, P < 0.001; H-reflex, P < 0.001) to electrical stimulation in patients with spasticity.

Conclusions: This systematic review has demonstrated the efficacy of cryotherapy in treatment of spasticity. Cryotherapy may be considered as an approach to treating spasticity in patients with neurological dysfunction. Especially, it can be applied with an ease of use and minimal side effect.
TITLE: Effect of a novel palatal alternative sensory feedback device on postural stability and dynamic balance: A Case Series

AUTHORS/INSTITUTIONS: C. Abbott, Physical Therapy, University of Missouri, Columbia, Missouri, UNITED STATES; B.F. Erhardt, A.L. Rivera, Otolaryngology, University of Missouri Health Care, Columbia, Missouri, UNITED STATES

ABSTRACT BODY:

Background & Purpose: 85% of 7 million annual clinic visits for dizziness and vertigo are diagnosed with vestibular disorder. Primary role of vestibular system is to allow efficient movement in a dynamic environment. Deficits in system increase fall risk and decrease quality of life. Compensation for deficits can occur with vestibular rehabilitation (VR) and use of alternative sensory feedback e.g., body weighting, vibration. Palatal stimulation uses the low electrical impedance and rich innervation of the palate to allow spatial localization of electrical impulses. Case series describes use of hidden and noninvasive palatal electrotactile stimulation device (PES) as an alternative form of sensory feedback for vestibular patients to improve postural stability in daily activities.

Case Description: Four patients (ages 18-85) with vestibulopathy and completion of VR were recruited for custom fit with PES (EquiCue). 3/4 patients exhibited residual vestibular symptoms and deficits. Dental retainer had an embedded sealed battery-powered electronic system consisting of an accelerometer and 5 stainless steel stimulators. The PES was calibrated to each patient's sensory sensitivity. Strong comfortable sensations were obtained at intensities of 25-30V. Patients underwent 1-3 90-minute training sessions by a physical therapist. Dynamic balance, gait and symptoms were respectively measured by EquiTest Sensory Organization Test (SOT), Dynamic Gait Index (DGI) and Numerical Pain Rating Scale (NPR) with and without the PES at each visit.

Outcomes: The PES was easy to calibrate and teach how to use the sensory input to provide head position and movement feedback. SOT: 4/4 patients had diminished or significant deficits with falls in visual and vestibular responses without PES; with PES 4/4 patients had immediate increased function in the visual and vestibular areas above normative levels; 3/4 exhibited posterior COG alignment without PES, all 4 showed centralized COG when wearing PES at last session; e.g., patient with significant vestibular deficits initially only able to complete 4/6 conditions with falls on conditions 5 & 6, on last session without PES she was able to complete SOT and scored above her normative range, no falls with Equilibrium Score of 78. DGI and NPR: 3/4 patients exhibited immediate relief of dizziness, nausea and unsteadiness with PES; able to perform pivot turns and stepping over obstacles without staggering; range of scores on DGI before and with PES was 11-21/21 at the first session; 19-21/21 at the last session.

Discussion: Comfortable perception of the electrical stimulus was possible along with improved COG alignment. Immediate and 2-3 week relief of dizziness and nausea was seen with PES training. Function and symptom improvements persisted when not wearing the PES at subsequent sessions. One patient who had compensated for her vestibulopathy was able to improve SOT scores with PES. Individuals with vestibulopathy experienced relief of vestibular symptoms and improved function during and after PES.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Mcdonnell MN, Hillier SL. Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. Cochrane Database Syst Rev. 2015;1:CD005397.


Action Observation Treatment in the Functional Retraining of an Individual with Cognitive Impairment following Traumatic Brain Injury: A Case Study

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L. DeMark, Clinical Research Center, Brooks Rehabilitation Hospital, Jacksonville, Florida, UNITED STATES
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Background & Purpose: Cognitive impairment is a long-term sequela of traumatic brain injury (TBI). Persistent cognitive dysfunction is associated with long-term disability in performing daily self-care and mobility tasks, as well as decreased participation in the vocational and social settings. Thus, the functional retraining of individuals with cognitive impairments is a critical challenge for rehabilitation professionals today. Current literature supports the use of action observation treatment (AOT) for retraining functional motor skills following stroke. However, research is limited regarding the efficacy of AOT for individuals with cognitive impairment from TBI. Therefore, the purpose of this case study is to introduce AOT as an effective therapy adjunct for the functional re-training of an individual with cognitive deficits following a TBI.

Case Description: The individual presented in this case study is a 72-year-old male who presented to an inpatient rehabilitation hospital with deficits in orientation and cognition after sustaining a frontal lobe subarachnoid hemorrhage from a fall. Baseline cognitive function was measured as 15/30 on the Montreal Cognitive Assessment (MoCA), indicating the presence of mild cognitive impairment. Initially the patient required maximal assistance on the motor subscale of the Functional Independence Measure (FIM), a performance-based clinical measure used to quantify levels of assistance required for self-care and mobility tasks. Intervention in this case included implementation of a 2-week AOT video protocol (totaling 60 min/day, 5 days/week). The daily protocol consisted of a 3-minute video observation of transfers (wheelchair, toilet, and car), followed by a 3-minute reflection period and 10 minutes of massed task-specific practice of the transfers. Progression toward independence was monitored weekly using the FIM and number of verbal cues provided for successful performance of the task. MoCA scores were collected weekly to monitor changes in cognition throughout training.

Outcomes: After two weeks, the FIM score for bed to chair transfer improved from 2/7 to 5/7. Verbal cues provided improved from 4 initially to 0 at final assessment. Despite improved physical function, cognition remained impaired at final assessment with a discharge MoCA score of 13/30. Orientation scores remained inconsistent throughout. Functionally, the patient discharged home with supervision from his wife, despite the continued significant cognitive deficits.

Discussion: Results of this case study suggest that use of AOT, in conjunction with massed task-specific practice, may be an effective means to facilitate motor learning and improve task performance in individuals lacking the cognitive capacity to follow a traditional learning model. Limitations include the absence of long-term follow-up data and a single subject design. Future research is necessary to assess the long-term effects of AOT on motor learning and transference of acquired skills to varying environments.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Dual-task walking impairments in older adults with mild cognitive impairment

AUTHORS/INSTITUTIONS: V.E. Kelly, E.L. McGough, Rehabilitation Medicine, University of Washington, Seattle, Washington, UNITED STATES|S.M. McCurry, R.G. Logsdon, L. Teri, School of Nursing, University of Washington, Seattle, Washington, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: This study compared the impact of a concurrent cognitive task on walking in people with mild cognitive impairment (MCI) and healthy older adults (HOA) to test the hypothesis that a concurrent task affects walking to a greater extent in older adults with MCI than in HOA.

Number of Subjects: 40 participants (18 MCI, 22 HOA)

Materials/Methods: This observational, cross-sectional study included a subgroup of participants from the Resources and Activities for Life-Long Independence (RALLI) study who were sedentary older adults, aged 75-95 years, and living in independent retirement homes. Participants with memory problems consistent with amnestic MCI were identified using Petersen criteria and neuropsychological testing. Quantitative gait analysis was performed under single-task (walking only) and dual-task (walking with a cognitive task) conditions. Spatiotemporal gait parameters were assessed across various domains: pace (speed), rhythm (swing time), asymmetry (swing time asymmetry), variability (step length variability), and postural control (step width). A cognitive task, serial-3 subtractions, was performed under single-task (while seated) and dual-task (while walking) conditions. Cognitive task performance was characterized by the number and the percentage of correct responses. Potential changes in single-task and dual-task performance were assessed using repeated measures analysis of variance with one within-subject factor (single-task, dual-task) and one between-subject factor (HOA, MCI).

Results: The MCI and HOA groups were similar with respect to age (p=0.30), height (p=0.34), and sex (HOA=7/22 M; MCI=5/18 M). Single- and dual-task walking were comparable between groups, but a main effect of task showed that both groups walked more slowly (p<0.001), with greater swing time duration (p<0.001), step length variability (p=0.03), and step width (p<.001), under dual- compared to single-task conditions. For the cognitive task, a main effect of task showed that both groups completed fewer correct subtractions under dual- compared to single-task conditions (p=0.001). A main effect of group also demonstrated that people with MCI had fewer correct subtractions (p=0.003) and a lower percentage of correct responses than HOA (HOA: 92% correct; MCI: 78% correct; p=0.02).

Conclusions: In contrast to some previous research, people with MCI and cognitively intact older adults demonstrated similar dual-task interference; however, people with MCI performed worse on the concurrent cognitive task. This suggests that a relatively smaller cognitive load can adversely impact walking for people with MCI compared to HOA.

Clinical Relevance: Functional mobility commonly requires us to walk while performing concurrent tasks. For people with MCI, walking may be disrupted even by simple concurrent tasks. Training appears to improve dual-task walking in people with Alzheimer's disease, suggesting promise for improvements in people with MCI, as well. Alternatively, compensatory strategies, such as reducing or eliminating cognitive demands while walking, may be more appropriate to ensure safety.
TITLE: Cardiorespiratory Fitness among Group Exercisers with and without Parkinson Disease who Exercise at Different Intensities

AUTHORS/INSTITUTIONS: S.A. Combs-Miller, L.R. Porch, W. Meardith, Z.J. Pigg, S. Sutter, Krannert School of Physical Therapy, University of Indianapolis, Indianapolis, Indiana, UNITED STATES|M. Beekley, Kinesiology, DePauw University, Greencastle, Indiana, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study was to examine differences in cardiorespiratory fitness (CRF) among three groups who participate community-based group exercise programs: people with Parkinson disease (PD) who exercise at high or moderate/low-intensity and healthy exercisers. We hypothesized high-intensity exercise in persons with PD would lead to higher levels of CRF than those with PD who exercise at lower intensities and would result in similar CRF levels to those of healthy exercisers.

Number of Subjects: Forty participants who regularly participated (at least 120 minutes/week for 3 months) in group exercise were enrolled in this cross-sectional study [high-intensity PD n=14, mean age 63.5(9.0), median months post diagnosis 54.5(41.0), Hoehn & Yahr 1-3; moderate/low-intensity PD n= 11, mean age 67.0(7.0), median month post diagnosis 63.0(60.0), Hoehn & Yahr 1-3; Healthy n=15, mean age 62.4(5.6)]. Rate of perceived exertion (RPE), 6-20 scale, defined self-perceived peak exercise intensity (high-intensity≥15, moderate/low-intensity≤14).

Materials/Methods: Participants completed two study visits, one week apart. During the first visit, demographic, health and exercise (minutes of exercise/week, peak RPE) characteristics were collected. Participants wore a step activity monitor for 5 consecutive days between visits. On the second visit, participants completed the comfortable 10-meter walk test (CWT), 6-minute walk test and a graded exercise test (GXT). Treadmill speed during the GXT was held constant based on each participant’s mean CWT with treadmill grade increased over the course of the test. Peak oxygen consumption (peak VO2), time to fatigue, respiratory exchange ratio, and final treadmill grade were recorded. Participants with PD completed testing during the ON phase of their PD medications. Analysis of covariance was used to examine differences between groups and to control for differences in gender.

Results: Groups did not differ in age or minutes of exercise (p>.05). Mean peak VO2 was significantly higher in the high-intensity PD group compared to the moderate/low PD group [high-intensity PD 34.6(8.1) and moderate/low-intensity PD 26.6(3.1), p<.01]. Neither PD group was significantly different in peak VO2 from the healthy group (healthy 30.8±5.6, p>.05). There were no significant differences across groups in any other outcomes (p>.05).

Conclusions: Regardless of level of intensity during exercise, all exercisers with PD had comparable levels of CRF to healthy exercisers. Findings support our hypothesis that participation in high intensity exercise by persons with PD results in significantly higher peak VO2 than those with PD who exercise at lower intensities. Regular exercise at a higher self-perceived RPE may be important to achieving optimal levels of CRF in persons with PD. Further research on the effects of exercise intensity in persons with PD is warranted.

Clinical Relevance: Physical therapists should encourage regular exercise for their patients with PD in order to optimize cardiorespiratory health and fitness.
ABSTRACT BODY:

Background & Purpose: Persons with Charcot Marie Tooth often present to physical therapy with impaired balance, which has traditionally been associated with musculoskeletal and sensory changes in the lower leg and feet. The purpose of this report is to present a systematic approach to evaluation of persons with Charcot Marie Tooth who present to physical therapy for imbalance and falls. This systematic approach should include assessment of the commonly impaired somatosensory and motor systems, as well as special consideration for vestibular involvement due to the neuroanatomical components of the vestibular system being peripheral in nature.

Case Description: A 55-year-old female with Charcot Marie Tooth Type 1A, and a report of unexpected falls, presenting to hospital-associated outpatient setting in the Philadelphia area. The patient's script read "vertigo: evaluate and treat," and her biggest complaint was unexpected falls without accompanying dizziness. Previous physical therapy intervention addressed the somatosensory and visual system's contribution to imbalance and falls, and she was using a rolling walker for ambulation at the time of the evaluation due to fear of falling.

Outcomes: A systematic structured examination was performed to assess the vestibular system. This examination included a mobility screen, a musculoskeletal examination, a somatosensory screen, balance testing, oculomotor testing, VOR testing, a screen for BPPV, posturography testing, and assessment of participation level outcome measures. The subjective complaint of fear of falling was supplemented by a score of 53.8% on the ABC scale, and the patient was at risk of falls based on her Berg score of 35/56. Other significant results included a positive head thrust test, impaired smooth pursuits, impaired VOR and VOR cancellation, as well as impaired subjective visual vertical. The findings of the examination were used to systematically drive the differential diagnosis process in which unilateral hypofunction with otolith involvement was ruled in and other vestibular diagnoses – such as BPPV, Meniere's, and central vestibular dysfunction – were ruled out.

Discussion: Upon evaluation, the patient presented with both somatosensory and motor changes affecting her balance, as well as a unilateral hypofunction. Just as the disease affects the peripheral nerves of the limbs, it can also affect the vestibular nerve as it is also considered a peripheral nerve. A systematic approach which includes a thorough examination of the vestibular system, as discussed in this case report, should be performed for persons with Charcot Marie Tooth with complaints of dizziness, falling, and imbalance in order to ensure a comprehensive examination and prevent errors of omission during the differential diagnosis process. Furthermore, inclusion of vestibular interventions to address these impairments allows for optimal outcomes related to patient specific symptoms and goals.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: Less Talk, More Motion: Partnering to Provide Physical Activity to Individuals with Neurologic Disability and their Caregivers

AUTHORS/INSTITUTIONS: S.L. Fritz, University of South Carolina, Columbia, South Carolina, UNITED STATES|R. Handlery, K. Handlery, R. Culbertson, C. Rivers, L. Zaring, S.H. Nester, Public Health, University of South Carolina, Columbia, South Carolina, UNITED STATES|

ABSTRACT BODY:
Purpose: To demonstrate the feasibility and value of implementing a community-based physical activity (PA) program for individuals with neurologic disability and their caregivers.

Description: Survivors of stroke and those with Multiple Sclerosis (MS) are at increased risk for osteoporosis, fatigue, depression, injurious falls and death from cardiovascular disease. Caregivers for these individuals share similar risks; both risks may be reduced with regular PA. Unfortunately, those with stroke or MS are significantly less active than the general population, and over half of caregivers are not meeting PA guidelines. There is a strong recommendation for PA intervention that involves caregivers, but these are usually to benefit the individual affected, not the caregivers themselves. Therefore, increasing PA levels for all aforementioned populations should be targeted. The current project was unique in that caregivers actively participated in PA and did not just assume the typical role as a facilitator.

Summary of Use: Through partnership with the YMCA, the NExT program (Neurological Exercise and Training) was able to offer the following: 1) group education and exercise instruction from a licensed physical therapist (PT), 2) a safe, low-cost and accessible venue to perform PA, and 3) the opportunity to exercise alongside others with chronic disability and also with other caregivers. The YMCA provided space and equipment for NExT, and all instructors (one PT and four PT students) were volunteers. NExT was free for YMCA members or $80 for non-members. While participants were encouraged to attend each session, there was no attendance requirement.

NExT was available 2 days a week for a total of 10 weeks. Each session was 1.5 hours, including time for pre and post vital assessment. Each session focused on strength, balance and aerobic training. Education was provided throughout the program including benefits of exercise, PA guidelines, safe use of YMCA equipment and for caregivers, how to safely facilitate exercise at home.

Feasibility: Ten individuals with chronic disability and 3 caregivers participated. No adverse events occurred during NExT. Attendance for all sessions was greater than 90%. For retention, 12/13 participants completed NExT in its entirety.

Value: All caregivers planned to continue PA at a local gym with their loved one, 71% of individuals with neurologic disability stated the same. Subjective comments from both parties demonstrated the value of NExT, with all participants indicating interest in further PA programs.

Importance to Members: These findings demonstrate that PTs can make an immediate impact in their community for those affected by neurologic deficits. Caregivers can enhance the recovery process, but their own needs should not be ignored. Everyone deserves a safe and accessible place to participate in PA, and PTs should play a role in transitioning the patient and caregiver from standard care to community-integration.
Purpose/Hypothesis:
Parkinson's Disease (PD) is associated with reduced physical activity and exercise. Wearable technologies may facilitate and improve long-term adherence to exercise in the home and community by PD patients. Both dance and wearable technology, which provide external auditory cues, have been shown to improve both motor and non-motor PD symptoms. Dual-task ambulation can impair functional gait characteristics and decrease confidence in participation, making individuals less likely to engage in regular exercise. Although wearable technology is becoming more accessible, low adherence can be a barrier to successful outcomes. The purpose of this study was to determine if mobility performance with cognitive load would be associated with the ability to safely use Google Glasses during guided dance in persons with PD.

Number of Subjects: 7

Materials/Methods:
For this cohort study, seven participants with idiopathic PD (3 males and 4 females, mean age 69 ± 5.5 years, Hoehn and Yahr (H&Y) 1-3, mean Unified Parkinson's Disease Rating Scale (UPDRS) motor 42±9.18, and Montreal Cognitive Assessment score >21 were enrolled in this study. Baseline assessments included: Mini-BESTest with specific interest in the Timed-Up and-Go (TUG) and Cognitive-TUG. Participants were provided one training session with Google Glasses preloaded with Moving Through Glass modules (Warm me up, Balance me, Unfreeze me, Walk with me), and demonstrated competency. These modules were created by the Mark Morris Dance group and SS+K for those with PD. Participants were asked to use dance modules at least once per day over a three-week period and log usage. All baseline assessments were repeated after the training session and during a follow-up visit. Statistical analysis was performed using JMP Software (SAS Institute) including Spearman's Rho for correlation of assessment score and device usage.

Results:
We observed no significant correlation between baseline performance on the Mini-BESTest, TUG, or Cognitive TUG and frequency of use of the device (p>0.05). Retrospective power analysis indicated n >55 subjects for adequate power to detect significant difference. No participants reported any adverse effects from use, or falls during the intervention.

Conclusions:
Dance interventions using Google Glasses place an additional cognitive demand on participants, but device usage does not appear to be associated with baseline assessment performance. Further analysis of the relationship of device usage, dance and functional outcomes is warranted to predict usage of augmented reality based glasses in the PD population with a larger number of participants.

Clinical Relevance:
Exercise is important for PD symptom management. Adherence to use of wearable technology during in home exercise programs is not associated with baseline functional assessment scores in that individuals with PD who have difficulty with dual task mobility may still be able to adhere to safely using wearable technology within their home.
TITLE: Internal Validation of the Vestibular Activities Avoidance Instrument (VAAI)

AUTHORS/INSTITUTIONS: G.F. Marchetti, Physical Therapy, Duquesne University, Pittsburgh, Pennsylvania, UNITED STATES|J.P. Staab, Psychiatry and Psychology, Mayo Clinic, Rochester, Minnesota, UNITED STATES|J.M. Furman, Otolaryngology, U of Pittsburgh, Pittsburgh, Pennsylvania, UNITED STATES|K. Alshebber, Physical Therapy, University Of Pittsburgh, Wexford, Pennsylvania, UNITED STATES|S.L. Whitney, Physical Therapy, University of Pittsburgh, Sewickley, Pennsylvania, UNITED STATES|P. Sparto, University of Pittsburgh, Pittsburgh, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Vestibular disorders cause physical and psychological symptoms that adversely affect individuals’ activities of daily living (ADLs), quality of life (QOL), and place burdens on individuals, families, and the healthcare system. Persons with vestibular disorders may avoid physical activities or limit their movement because of their fear of provoking symptoms. These physical activities are very important for compensation, and avoiding them can contribute to greater disability. The purpose of this study was to provide a description of the psychometric properties of a new measure of avoidance, including internal consistency, test-retest reliability and internal/external structure validity in persons with vestibular disorders.

Number of Subjects: A convenience sample of 106 subjects, (62 females, 44 males) with an average age of 52.6 y (SD 14.2 y, range 21-82 y) who were referred to a neuro-otologist at the University of Pittsburgh Medical Center was utilized.

Materials/Methods: A cross-sectional descriptive study was used to determine the reliability of the VAAI. Patients completed the VAAI (77 items) during their initial visit. On the same day, a second VAAI with questions in a different order was given to the participants at least 45 minutes after completing the first VAAI. Test-retest reliability of the two initial administrations of the VAAI were determined using the Intraclass correlation coefficient (ICC 3, 1). Agreement between subject ratings on successive test administrations for individual items was estimated using weighted kappa. Standard error of the measurement (SEM) and the minimal detectable change (MDC95) were calculated. Exploratory factor analysis was used to explore underlying constructs and the test item associations with each identified construct.

Results: The test-retest reliability of the total score of the VAAI was excellent ICC=0.97; 95% confidence interval, 0.95–0.98. Weighted kappa for the VAAI agreement per-item was poor to excellent (0.1-0.8). The SEM of the VAAI was 13.2 and the minimum detectable change (MDC) for the VAAI total score was 36.5. Eighteen constructs were identified as underlying the expression of significant fear avoidance due to dizziness.

Conclusions: The VAAI is a newly developed tool that identifies persons with avoidance behavior who were diagnosed with vestibular disorders. The VAAI demonstrates excellent reliability. Fear-avoidance behaviors in the presence of dizziness-imbalance appear to be based on several underlying constructs that warrant further investigation. Further analysis to identify item inter-correlation and possible redundancy, factor structure and an optimal scoring paradigm will facilitate a reduction in the number of avoidance items.

Clinical Relevance: Timely identification of activities avoidance in individuals with vestibular disorders may allow physical therapists to set appropriate intervention goals, incorporate psychologically-informed intervention strategies, and improve clinical outcomes.
**Title:** Investigating vestibular rehabilitation with a person with Charcot Marie Tooth Disease and its effects on fatigue.

**Authors/Institutions:** A. Fangman, University of Washington Medical Center, Seattle, Washington, United States

**Abstract Body:**

**Background & Purpose:** Charcot Marie Tooth disease (CMT) also known as hereditary motor and sensory neuropathy (HMSN) is among the most common hereditary peripheral neuropathies. It presents with motor and sensory peripheral nerve deficits, which includes deficits of the cranial nerves. The vestibulocochlear nerve, cranial nerve eight, has been identified as impaired in persons with CMT and is integral for gaze stabilization, spatial orientation, and postural control. A common symptom in individuals with peripheral nerve disorders is fatigue, which can be very debilitating and reduce the individual perception of their quality of life. Fatigue is a very complex symptom that can be derived from both psychological origin and physical origin. The purpose of this study is to identify vestibular impairment in a client with CMT and determine the impact of vestibular intervention on fatigue.

**Case Description:** 16 year old female with congenital Charcot Marie Tooth disease, presented to an outpatient clinic for gait training and balance. The client was seen for 11 visits over 3 months. Interventions included vestibular adaptation, strength training, gait training, postural control exercises, and a home exercise program. Outcome measures included the 10MWT, 6MWT, Dizziness Handicap Inventory (DHI), dynamic visual acuity (DVA), modified clinical test of sensory integration on balance (mCTSIB), numerical fatigue rating scale and patient specific functional scale.

**Outcomes:** This individual demonstrated improvement in postural control, gait mechanics, gaze stability, and her perception of activity tolerance. She increased her time on condition four of mCTSIB by 7 seconds. Her DVA improved from a 5 line difference to a 3 line difference, indicating improved functional use of the vestibular ocular reflex. She increased her patient specific functional task of walking longer at the mall without having to stop by 3 points indicating minimal detectable change for single activity. Her numerical fatigue rating scale varied throughout the sessions usually stating low fatigue at the beginning of the session and high fatigue at the end of the session. It also did not reduce over time. She also did not improve her 6MWT but maintained distance walked with same RPE. She is now walking with less lateral deviation and hip external rotation during stance phase.

**Discussion:** This case study suggests that this 16-year-old client with CMT improved in postural control, spatial awareness, functional and participation activities with vestibular rehabilitation, gait training, and strengthening. It does not suggest fatigue was addressed with these same interventions. The literature supports including vestibular assessments in the physical therapy examination for individuals with CMT. The literature reports fatigue is a common symptom seen in persons with CMT but has not addressed how to intervene. Further research with a larger number of subjects would be beneficial.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Factors Associated with Functional Outcomes Following Acoustic Neuroma Resection

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ABSTRACT BODY:
Background & Purpose: Acoustic neuroma (AN), also known as vestibular schwannoma, is a benign tumor of the 8th cranial nerve that occurs in 1 to 20 people per million per year (yr). Resection of AN results in acute vestibular dysfunction, and can result in altered gain of the Vestibulo-Ocular Reflex, experienced as retinal slip or blurred vision. Ambulation, balance, and vestibular exercises have been shown to be effective immediately status post (s/p) resection. Functional recovery has been assessed through clinical reviews where as much as 33-38% of patients (pts) are unable to return to their job due to dizziness, hearing impairments, balance issues, and facial weakness. The heterogeneity of these results suggest unknown perioperative factors may contribute to variability in long term (LT) outcomes following surgery. The purpose of this series is to explore pt demographics, symptoms (SXs), and mobility levels s/p resection of an AN to identify possible factors that may impact LT outcomes.

Case Description: 11 consecutive pts aged >17 yrs s/p AN resection who attended regular follow-up visits for postoperative (post-op) vestibular rehabilitation in 2016 were enrolled. The Activities-specific Balance Confidence (ABC) scale and Dizziness Handicap Inventory (DHI) were assessed 3 months (MOs) post discharge from the hospital. Scores averaged 58.1%, and 49% disability, respectively. On the ABC, where scores < 67% indicate a fall risk (FR), 82% of pts in this series were identified to be a FR. The Functional Gait Assessment (FGA) yielded a mean score of 23/30. 45% of pts scored < 23, and are considered FRs. 54% of pts reported at least 1 post-op fall.

Outcomes: Gait Speed (GS), DHI, ABC, FGA

Discussion: Preoperative (pre-op) factors may be useful in determining prognosis and necessity of skilled intervention via the identification of risk factors associated with poor recovery. In prior studies, tumor size and post-op facial nerve function (FXN) has been correlated. Other factors such as age >55.5 yrs, female gender, disequilibrium for >3.5 MOs, and central findings were associated with increased risk of persistent disequilibrium s/p AN resection. LT tracking of disability and FXN was measured through activity and participation level. Initial findings in this series indicate that pts s/p AN resection may have greater disability than previously reported, especially considering measures of FXN in daily life. Postsurgical ambulation distance appears to be positively correlated with GS, balance self-efficacy, and stability in gait at 6 MOs follow-up, but negatively correlated with disability due to dizziness. Other early mobilization factors such as time to mobilization appear to have similar relationships with LT outcomes, suggesting that early intervention and functional movements may benefit pts in the LT. This is the first series to assess LT mobility outcomes s/p AN resection such as disability, balance self-efficacy, and FR. Further studies need to be performed to determine causation as to which pre-op factors influence the LT quality of life outcomes.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Passier L, Doherty D, Smith J, McPhail SM., Vestibular rehabilitation following the removal of an acoustic neuroma: a systematic review of randomized trials. Head & Neck Oncology. 2012 Sep 9;4(2):59
Improving functional independence through task specific training despite severe hypertonicity in a patient with Neuro-Behçet's: a case report

AUTHORS/INSTITUTIONS: P. Spigel, Institute of Higher Learning, Brooks Health, Jacksonville, Florida, UNITED STATES|A. Link, Brooks Rehabilitation, Jacksonville, Florida, UNITED STATES|H. Foster, Brooks Rehabilitation Hospital, Jacksonville, Florida, UNITED STATES|L.A. Perry, Physical Therapy, University of St. Augustine for Health Sciences, St. Augustine, Florida, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Neuro-Behçet's disease (NBD) is a rare disorder of unclear etiology that can manifest as a variety of neurological impairments. Medical management is published, however there is an absence in physical therapy (PT) related management. This makes the rehabilitation approach challenging with risk of increased variability in practice. The purpose of this case report is to provide an overview of NBD and report outcomes after providing a task specific rehab approach for a young man with NBD in outpatient PT.

Case Description: The patient was a 26 year-old male diagnosed with NBD one year prior to being referred to outpatient rehabilitation services. Initial PT examination revealed impairments of motor performance, posture, range of motion and hypertonicity and extensor synergy patterns in the right lower extremity (RLE), more than left, limiting the patient's independence.

Outcomes: Impairment and performance based measures were reassessed at visit 18 demonstrating improvements in both. The Fugl-Meyer lower extremity subscale score for the RLE increased from 3/23 to 11/23 demonstrating emergence of increased isolated movements. The Functional Independence Measure (FIM) improved from a score of 1 at baseline to 5 and 4 for bed mobility and transfers, respectively. Thus indicating an improvement form total assistance to minimal assistance, allowing for decreased burden of care. The Five time Sit to stand improved from total assistance at baseline to 87 sec completion with supervision and use of hands. The Trunk Impairment Scale (TIS) and Postural Assessment Scale for Stroke Patients (PASS) assessed postural control and both scores improved greater than the MCID from 0 to 13/23 and 11 to 25/36 respectively. Gait was assessed using the FIM and 10 meter walk test. The patient improved from dependent wheelchair user, or 1 on the FIM for ambulation, to a 4 requiring minimal assistance, with a gait speed of .14m/s using a rollator walker, classifying him as a household ambulator.

Discussion: This case report describes the outcomes of a patient with Pontine NBD who demonstrated clinically meaningful improvements during outpatient PT as evidenced by improvements above the MCID on select outcome measures. Due to the paucity of research in this health condition, outcome measures that are valid and reliable for conditions presenting similarly to NBD were used to show objective change scores and limitations exist with validity of interpretation. Further research must be completed to identify these measures as valid and reliable for NBD. Successful improvements may be attributed to the application of interventions based in the framework of task-specificity and neuroplastic principles such as high intensity, high repetition and salient functional re-training. Even with the challenging clinical presentation and paucity of literature regarding management of patients with NBD, these patients are good candidates for physical therapy referral and have excellent rehabilitation potential.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
**Title:** Backward Walking Training to Target Forward Walking Speed, Dynamic Balance and Balance Confidence Post-Stroke: A Case Series Report

**Authors/Institutions:** D.K. Rose, Physical Therapy, University of Florida, Gainesville, Florida, UNITED STATES | J. Howarth, Brooks Rehabilitation, Jacksonville, Florida, UNITED STATES | A. Vistamehr, C. Conroy, Motion Analysis Center, Brooks Rehabilitation, Jacksonville, Florida, UNITED STATES | L. DeMark, Clinical Research Center, Brooks Rehabilitation Hospital, Jacksonville, Florida, UNITED STATES | D.J. Clark, Brain Rehabilitation Research Center, Malcom Randall VA Medical Center, Gainesville, Florida, UNITED STATES | C. Patten, E.J. Fox, Physical Therapy, University of Florida, Gainesville, Florida, UNITED STATES

**Abstract Body:**

**Purpose/Hypothesis:** Impaired balance and decreased balance confidence are common sequelae that contribute to slow gait speed and more significantly to increased fall risk post-stroke. Standard static and dynamic balance exercises and gait training are not sufficient to address these impairments. Given the unique postural and lower extremity motor control demands of walking backwards, Backward Walking Training (BWT) may provide benefit for individuals with post-stroke gait impairment. The purpose of this case series is to examine the effects of BWT on forward walking speed, dynamic balance and balance confidence in adults with chronic stroke.

**Number of Subjects:** Six adults with first time ischemic stroke (5 male; 4 right hemisphere; mean time post-stroke 11.5±3.4 months; mean age 57.0±6.6 years; mean Lower Extremity Fugl-Meyer Motor Score 25.7±2.7) participated. Participants were discharged from formal therapy and provided written informed consent prior to enrollment in a gait rehabilitation study.

**Materials/Methods:** Following baseline assessment, participants engaged in eighteen intervention sessions (3x/week for 6 weeks) of BWT on a treadmill with Body Weight Support for 20 minutes followed by 20 minutes of BWT over-ground. Appropriate gait kinematics were facilitated by a physical therapy team. Speed, limb loading and bout duration were progressed across sessions. Outcome measures assessed pre- and post-intervention included Activities-Specific Balance Confidence (ABC) Scale, 3-meter Backward Walk Test (3MBWT), and the Functional Gait Assessment (FGA). Spatial-temporal gait characteristics were measured during forward walking with a GaitRite system. Paired t-tests compared pre- to post-intervention values.

**Results:** Following BWT, balance confidence measured by the ABC scale increased from 60.5±6.9% to 68.6.2±6.1%. Forward gait speed increased from 0.60±0.05 to 0.67±0.06 m/s with increases in both paretic (44.5±3.3 to 50.1±1.9 cm) and non-paretic (37.3±3.5 to 41.9±3.2 cm) limb step length. Non-paretic step length increase was associated with an increase in paretic single limb stance from 24±3% to 27±3% of the gait cycle. These gains were all statistically significant (p < 0.05). Gains in the FGA and 3MBWT did not reach statistical significance (p > 0.05).

**Conclusions:** Both forward gait speed, to promote community participation, and balance confidence, an important factor in reducing fall risk and increasing quality of life, increased following BWT. Increased non-paretic limb step length may be associated with increased paretic limb hip extension in terminal stance, often impaired post-stroke and key to forward progression and recovery of a normal gait pattern. A direct comparison of BWT to forward gait training is the next investigative step for this novel treatment approach.

**Clinical Relevance:** BWT may be an important addition to the physical therapy intervention toolbox for gait rehabilitation post-stroke due to the observed improvements in spatial-temporal gait characteristics, walking speed and confidence in daily activity performance.
TITLE: Mobilization of patients in aneurysmal subarachnoid hemorrhage vasospasm using an early mobilization physical therapy algorithm: a retrospective study.

AUTHORS/INSTITUTIONS: J. Ramos, E.M. Hallett, R.M. Durling, Rehabilitation Services, University of California San Francisco Medical Center, San Francisco, California, UNITED STATES|C.D. Printz, Physical Therapy and Rehabilitation Science, University of California San Francisco, San Francisco, California, UNITED STATES|J. Lee, Physical Therapy, University of California San Francisco/ San Francisco State University, San Francisco, California, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Patients who sustain an aneurysmal subarachnoid hemorrhage (aSAH) can experience cerebral vasospasm which can lead to tissue ischemia or necrosis. Current conventional practice in most hospitals within the United States suggests keeping patients on bedrest when they are in vasospasm following aSAH, often in the neurological intensive care unit (ICU), because these patients can have substantial neurological impairments with changes in cerebral flow. However, at the University of California-San Francisco Medical Center (UCSFMC), a novel physical therapy (PT) algorithm is being utilized to promote early mobilization of patients with aSAH vasospasm to expedite a patient’s return to function. The purpose of this study is to characterize the patient population and mobility patterns/changes when treating patients in vasospasm using the PT algorithm.

Number of Subjects: 28

Materials/Methods: A retrospective chart review was performed for patients who had a diagnosis code of “subarachnoid hemorrhage”, received PT services within the neurological ICU, and were discharged from UCSFMC between 10/1/14 to 5/31/16. Patients were included if they were 18 years of age or older, admitted to UCSFMC within 5 days of their subarachnoid hemorrhage, had their aneurysm secured via clipping/coiling procedures, were in active vasospasm and were cleared to mobilize by their primary physician. The patients were excluded if they had a Glasgow Coma Scale (GCS) Score less than 6, had a subarachnoid hemorrhage due to trauma or AVM, had medical care withdrawn, had an elective clipping or coiling, or had an unstable or unsecured aneurysm.

Results: There were 28 patients who met inclusion criteria (23 female, 5 male, with mean age 52.89 +/- 14.43 years). Patients had a neurological ICU stay of approximately 2 weeks, and were seen by PT a mean of 6.04 +/- 2.25 sessions. At baseline, majority of patients had Hunt and Hess scores of 2-3, and Fisher Scale scores of 3-4. Mean GCS score at initial PT evaluation was 12.54 +/- 2.65. Baseline Activity Measure-Post-Acute Care (AMPAC) 6 Clicks total score was 14.7 +/- 5.8. At discharge, AMPAC 6 Clicks score increased to 16.6 +/- 5.13, with 53.6% of patients improving, and 28.6% remaining at the same level. Initial Global Assessment of Mobility score was 5.5 +/- 2.9, (5: able to actively transfer to a chair) improving to 7.4 +/- 2.5 (7: able to stand >10 seconds), with 67.9% of patients demonstrating progression, and 21.4% with no observed changes in mobility.

Conclusions: Early results of the UCSFMC early mobilization PT algorithm indicate that early rehabilitation for patients in vasospasm after aSAH is feasible. In patients who received PT intervention, the majority of patient mobility scores reflected an improvement or maintenance of physical function.

Clinical Relevance: These findings may help inform clinicians and guide safe practice when mobilizing patients in cerebral vasospasm after aSAH.
Knowledge in Translation: Application of variable intensive stepping training for a patient with chronic acquired brain injury


ABSTRACT BODY:

Background & Purpose: Variable intensive stepping training has been found to have positive effects on people with neurologic conditions. Specifically, Hornby et al assessed the effect of high intensity, variable stepping training on walking and non-locomotor tasks in people with subacute strokes. Results showed improvements in gait speed, endurance, gait symmetry, sit to stand efficiency and balance confidence. There is no published literature regarding variable stepping for people with chronic brain injuries. The purpose of this study was to determine the feasibility of variable intensive stepping for a person with chronic acquired brain injury.

Case Description: The patient was a 37 year old female who had a left aneurysm rupture causing an acute subarachnoid hemorrhage resulting dense right sided hemiparesis and aphasia. After undergoing inpatient and outpatient rehabilitation acutely, she was a limited community ambulatory with a double metal upright ankle foot orthotic (AFO) and unilateral forearm crutch. The patient presented to outpatient physical therapy 18 months post injury after receiving a new right carbon fiber AFO. The patient’s functional goals were to improve community ambulation with carbon fiber AFO and to be able to go for hikes in the woods with her AFO to achieve her prior level of function.

Outcomes: During initial evaluation, the patient presented with force production deficits of her right lower extremity with no active movement in her ankle and no isolated hip flexion. During gait, the patient ambulated with left forearm crutch and demonstrated right ankle inversion and knee recurvatum in mid-stance with posterior pelvic rotation and circumduction during mid-swing. She was at risk for falling and had decreased confidence per the FGA and ABC.

Using the framework established by Hornby et al. variable stepping interventions were performed 2x per week for 11 weeks. This included outdoor negotiation, stair training, obstacle courses and dynamic gait tasks in a structured progression. Intensity was measured via heart rate.

At discharge from physical therapy she had improvement in right knee extension and hip flexion force production via manual muscle testing. She also demonstrated improvement balance and confidence as indicated by FGA increase from 21/30 to 23/30 and ABC improvement from 56% to 79% placing her a decreased risk for falling. The patient was also able to return to hiking outdoors with carbon fiber AFO and a walking stick.

Discussion: This case report demonstrates that variable intensive stepping as described by Hornby et al can be successfully applied to a patient with chronic acquired brain injury. Not only was it feasible, it resulted in improvement in the patient’s confidence and balance as well as meeting her functional goals. Appropriate intensity needs to be monitored and achieved to reach optimal challenge for neurologic rehabilitation.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: The effect of extra functional electrical stimulation cycling practice using bandwidth feedback on length of stay and fall risk in acute stroke survivors receiving inpatient rehabilitation

AUTHORS/INSTITUTIONS: Z.C. Crump, A.M. Lyons, P. Carroll, L. Shuping, Physical Therapy, Sheltering Arms Rehabilitation, Richmond, Virginia, UNITED STATES|P. Pidcoe, Physical Therapy, Virginia Commonwealth University, Richmond, Virginia, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis: Functional electrical stimulation (FES) cycling has grown in its implementation for both chronic and acute stroke survivors. The use of extra Physical Therapy (PT) practice among acute stroke survivors has also shown some benefit in regards to decreased hospital length of stay (LOS). Bandwidth feedback (BWF) with FES cycling has not been examined, although some promising results have been shown with standard cycling and biofeedback. The purpose of this study is to determine if extra FES cycling with BWF in an inpatient rehabilitation setting for acute stroke survivors leads to shorter hospital LOS and decreased fall risk as compared to extra FES cycling without feedback. The authors hypothesized that extra FES cycling with BWF would decrease hospital LOS and fall risk compared to controls.

Number of Subjects: 34 (to date)

Materials/Methods: A total of 34 first time acute/sub-acute stroke survivors receiving inpatient rehabilitation were enrolled in the study to date. The control group (n=18) received no less than 6 extra FES cycling sessions without feedback in addition to task specific PT. The experimental group (n=12) received no less than 6 extra FES cycling sessions with standardized BWF commands in regards to cycling speed in addition to task specific PT. Average inpatient hospital LOS was recorded in addition to fall risk as measured by the Timed Up & Go (TUG), 10 meter walk test (10 MWT), and Berg Balance Scale (BBS). Outcome measures were assessed on hospital admission, at discharge, and at 1 month follow-up.

Results: In the control group, 18/22 patients completed a minimum of 6 extra FES cycling sessions, with average change scores of 19 points for the BBS, .33 meters/second for the 10 MWT, and 154 seconds for the TUG with an average inpatient rehabilitation hospital LOS of 31 days. Results are pending with the experimental group, which limit between group comparisons at this time. To date, 11/12 enrolled patients in the experimental group have received at minimum 6 extra FES cycling sessions. One month follow up outcomes are pending examination. The authors anticipate a decreased inpatient rehabilitation LOS for the experimental group compared to the control group based on the current available data.

Conclusions: Based on available data, extra FES cycling is a feasible intervention for acute stroke survivors receiving inpatient rehabilitation and has decreased fall risk among extra practice participants in both groups. Comparisons between groups are limited at this time as the remaining experimental group data is pending analysis.

Clinical Relevance: Extra FES cycling requires less physical assistance than other extra practice interventions and BWF interventions have received limited attention in current literature. The potential for these two interventions to decrease hospital LOS while concurrently decreasing fall risk for acute stroke survivors requires closer examination to determine its effectiveness.
Orientation and Mobility training in an individual with acquired blindness in setting of TBI with a left horizontal midline shift.

AUTHORS/INSTITUTIONS: N. Keenan, Swedish Medical Center, Arvada, Colorado, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Orientation and mobility training techniques are well established in those with congenital blindness; however, minimal literature exists on training with acquired blindness. Additional challenges existed with this patient due to TBI with horizontal midline shift. Furthermore, treating a vertical midline shift in setting of CVA has been well established, but no literature is available for treatment of a horizontal midline shift. The purpose of this case study was to establish treatment for horizontal midline shift while teaching mobility skills in setting of acquired blindness.

Case Description: An individual with acquired blindness due to a GSW to temporal bone presented with left horizontal midline shift during mobility. As a result of the GSW the patient had cerebral edema; requiring bilateral frontal craniectomies, and transected bilateral optic nerves. The patient was seen in an acute care setting starting four days post injury. Patient presented with a midline shift 45 degrees toward the left with ambulation due to poor spatial orientation; in addition to poor balance and decreased strength. Mobility training provided as the patient progressed from a Rancho Level IV to Rancho Level VI throughout the course of a one month hospitalization.

Outcomes: The patient was seen for 28 treatment session over the course of a 36 day hospitalization. The patient required moderate assist for balance and orientation during ambulation during initial therapy sessions. The patient was unable to follow a wall for orientation, letting go of the handrail on wall in preference for turning 45 degrees toward the left as the patient continued to walk. A series of seated and standing proprioception reaching tasks were performed with both upper and lower extremities to aid with orientation. During ambulation five pound weights were used on the right upper and lower extremities to correct midline shift. Additionally manual facilitation was utilized at the pelvis and shoulders to further aid with midline orientation. At the time of the patients discharge from the hospital the patient was able to use guidance cane to navigate hallways while maintaining midline orientation for 30-45’ intervals prior to slow left drift. Patient was able to correct left drift with verbal cues only, reorienting self to midline. Additionally, the patient’s balance improved to 46/56 on Berg Balance Assessment, with all tasks being more difficult due to blindness.

Discussion: This case study demonstrates that the use of unilateral weights and proprioceptive training is an effective treatment for a horizontal midline shift in setting of acquired blindness. Furthermore, this treatment can be utilized in individuals with a traumatic brain injury as he/she progresses through the Rancho recovery stages.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: The effects of maximal strength training on mobility deficits in persons with Multiple Sclerosis: partial results of an ongoing study.

AUTHORS/INSTITUTIONS: M. Zervas, M. Wnukowski, K. Kaems, A. Cerrati, N. Chan, M. Shamsian, H. Karpatkin, Physical therapy, Hunter College, City University of New York, New York, New York, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Physical therapists may resist prescribing high intensity strength training for patients with Multiple Sclerosis (pwMS) due to concerns about fatigue. We recently published a pilot study showing that Maximum Strength Training (MST), using weights of 85-95% of the 1 rep Maximum (1RM), is safe and feasible in pwMS, with subjects showing improvements in their strength, Six Minute Walk Test (6MWT), and Berg Balance Scale scores following 8-weeks of unilateral leg press training. The purpose of this current study is: 1) to repeat the MST protocol with a larger sample, 2) add two additional exercises to the pilot protocol and 3) utilize more extensive measures. We hypothesize that the pilot study findings will be confirmed, with pwMS showing improvements in all measures without adverse effects. If our hypothesis is correct, it will reaffirm that MST is a safe, feasible, and effective intervention to improve gait and balance in pwMS, as well as provide more specific guidelines to utilize this intervention.

Number of Subjects: 8 (5 females, 3 males), Expanded Disability Status Scale (EDSS) 4.25 (1.5-6.5) completed the program.

Materials/Methods: A pretest/posttest design was used. Baseline characteristics including Multiple Sclerosis Impact Scale-29, Fatigue Severity Scale (FSS), and Modified Ashworth Scale (MAS) were collected. Strength of hip extensors, knee flexors, extensors, and ankle plantarflexors was collected via handheld dynamometry. Outcome measures included the 6MWT, the Mini-BESTest (MBT) and the Stair Climbing Power Test. Subjects completed a 2x/week program for 8 weeks of unilateral leg press, knee flexion, and ankle plantarflexion, performing 4 sets of 4 repetitions at 85-95% of their 1RM, completing 2 out of 3 exercises per session. Increases in weight were determined by subject capability and preference. Fatigue was measured each session using the Visual Analog Scale of Fatigue, and weekly with the FSS.

Results: Paired sample T-tests were used to test for differences in pre to post outcome measures. In the 6MWT, significant differences were found between pre (M=1895, SD=680) and post MST (M=2071, SD=728) scores; t(7)=-3.177, p = .016. In the MBT, significant differences were found between pre (M=12.5, SD=3.6) and postMST (M=14.1, SD=3.6) scores; t(7)=-2.6,p=.035. FSS and MAS scores did not change significantly from pre to posttest.

Conclusions: Statistically significant improvements in the 6MWT and MBT are noted, without increase in fatigue or spasticity, confirming that the program is feasible, well tolerated, and effective. The relatively wide range of EDSS scores suggests the program can be utilized in a wide spectrum of disability. The improvements in gait and balance occurred despite the absence of specific gait and balance interventions.

Clinical Relevance: The results of this ongoing study are consistent with and expands upon our previous work, suggesting MST is a safe and effective intervention, and that pwMS can benefit from a higher intensity of intervention than might have previously been thought.
TITLE: Utilizing Intensive Aerobic Training to Improve Command Following in a person with altered level of consciousness: a case study


ABSTRACT BODY:

Background & Purpose: Diffuse axonal brain injury (DAI) is a common result of traumatic brain injury (TBI) and often causes damage to white matter tracts, leading to altered levels of consciousness (LOC). There is limited evidence for best practice to improve levels of arousal in persons with TBI and DAI. There is research to support aerobic conditioning on neuroplasticity, indicating that aerobic activity can promote neuroprotection following injury. In normal populations, evidence suggests that exercise can lead to improved cognition and arousal and increase brain derived neurotrophic factors (BDNF). Increase in BDNF is correlated with neuronal transmission and plasticity; increased neurogenesis; and improved mental performance in healthy individuals. It is understood that people with disorders of consciousness (DOC) demonstrate decreased levels of arousal and impaired command following. However, there is currently no evidence to support the use of intensive aerobic activity to improve levels of arousal or command following in persons with DOC. The purpose of this study is to determine the effectiveness in using high intensity aerobic training in persons with TBI to improve arousal and command following.

Case Description: A 58 year old male status-post fall from a ladder with resultant severe TBI. Imaging revealed DAI, intraparenchymal hemorrhages in the frontal lobe, left thalamus, right dorsal pons, and right occipital lobe, subdural hematomas with subarachnoid hemorrhage, and hemorrhaging in bilateral ventricles. Upon admission to inpatient rehab, he scored a 2 on the Rancho Los Amigos Scale and a 4 out of 23 on the Coma Recovery Scale, revised, indicating severe impairments in LOC.

Outcomes: The patient participated in a command following protocol in 4 positions including: seated in chair, during ambulation via treadmill training on the Lokomat, during static stand immediately following ambulation, and while performing a low intensity aerobic task via a lower extremity ergometer. The patient demonstrated 100% response rate and accuracy rate via motor responses (close eyes, stick out tongue) during ambulation (n=16) and while on the ergometer (n=8). In contrast, he demonstrated a 75% response rate with 94.4% accuracy when seated in a chair and 70% response rate with 100% accuracy during static stand. Ten weeks following his initial rehab admission, the CRS score improved to 23, indicating improved cognitively-mediated responses.

Discussion: It is well studied that exercise can improve BDNF, arousal, and mental performance in normal populations but, while more rigorous studies are required to determine the reliability of this data, this case demonstrates the role of exercise in improving level of arousal and consciousness in acute TBI. The results of this study demonstrate that there is improved response rate and accuracy rate of command following during active aerobic activity. For therapists working with persons with DOC, use of high intensity aerobic training could be used to improve LOC and arousal.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


ABSTRACT BODY:

Background & Purpose: The integration of neuropsychology with physical therapy (PT) rehabilitation of the Spinal Cord Injury (SCI) population has been found to decrease the incidence of depression and improve motor function outcomes. Most studies have been conducted after discharge home from inpatient rehab or in the chronic stage of SCI. The purpose of this case report is to discuss how the early integration of neuropsychology in combination with PT can facilitate discharge planning, improve Functional Independence Measure (FIM) scores, despite the biopsychosocial complexity in an acute SCI case.

Case Description: The patient was a 24-year old male who was involved in a motor vehicle accident. Based on the American Spinal Injury Association (ASIA) International Standards for Neurologic Classification of SCI (ISNCSCI) upon admission, the patient was diagnosed with a traumatic T2 ASIA A (complete) SCI. He presented with absent motor control, sensation and proprioception below the level of the lesion, flaccid tone, and impaired trunk control. The FIM and the Spinal Cord Independence Measure (SCIM) were used to assess the patient’s level of independence. PT interventions occurred in three phases with the overall goal to maximize independence. The three phases were completed in conjunction with the neuropsychologist who encouraged resiliency through deliberate educational interventions, improved participation and expectations regarding recovery potential. The neuropsychological interventions focused on emotional adjustment with active participation versus passive processing of emotions.

Outcomes: Following four weeks of inpatient rehab, the patient made significant improvements in both objective and self-report measures. He improved his overall motor FIM score from 4 to 22. This 18-point change is greater than the minimally clinically important difference, demonstrating a clinically significant improvement for his ability to complete all transfers, bed mobility and wheelchair mobility. With regards to the SCIM, the patient improved his score from 16/100 to 53/100 across all domains. Although not objectively measured, neuropsychological improvements evolved from being quiet with sudden outbursts of anger, to wanting to communicate with therapy staff and participate in his care. Despite several barriers, the patient discharged home independently, requiring the least amount of assistance from his support system.

Discussion: Overall functional independence significantly improved after receiving concurrent neuropsychology and PT intervention. The outcomes of this case suggest that combining neuropsychology and PT for SCI rehab in the inpatient setting may be a valuable intervention strategy in order to maximize functional outcomes and facilitate discharge planning. With continued research, this may provide an effective framework of delivering a multidisciplinary intervention approach to enhance outcomes of motor recovery and improve discharge disposition to home, despite complex psychosocial complications within the SCI population.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Evaluating the Effects of Transcutaneous Spinal Cord Stimulation on Motor Evoked Potentials and Posterior Root Muscle Reflexes

Purpose/Hypothesis: Neurological damage often results in spasticity, including hyperreflexia and dyssynergia, which impairs motor control and impacts activities of daily living (ADLs). While this is often treated pharmacologically, physical therapy plays a key role in helping these individuals manage spasticity through positioning, exercises, and stretches. A newer technique known as transcutaneous spinal cord stimulation (tSCS) has been shown to modulate spasticity in individuals with spinal cord injuries, though the mechanism of action is unclear. Therefore, the purpose of this research was to examine the effects of tSCS on motor evoked potentials (MEP) and lower limb posterior root muscle reflexes (PRMR) in healthy subjects. We hypothesize that after a bout of tSCS, lower limb reflexes will show reduced amplitude without similar changes in MEPs.

Number of Subjects: 22

Materials/Methods: Twenty-two healthy participants were recruited for this study. Each subject had electromyography (EMG) electrodes placed over specific muscles in both lower extremities. Each subject underwent baseline PRMR and MEP evaluation followed by a bout of tonic tSCS, and then repeated PRMR and MEP evaluations. For PRMR elicitation and tonic tSCS, we used two electrodes with one placed over T11/12 spinous processes and one on the abdomen. Tonic tSCS was applied using a neuromuscular stimulator for 15 minutes at a tolerable intensity high enough to elicit paresthesia in the feet. MEPs were stimulated using a transcranial magnetic stimulator (TMS) over the lower extremity motor cortex of the brain targeting the left tibialis anterior.

Results: The results of the study show that on average the hamstring and soleus PRMRs are significantly reduced by 10-15% immediately after a bout of tSCS. However, after the washout period, all PRMR amplitudes were reduced with average decreases ranging from 5-30%, where quadriceps and tibialis anterior show the smallest decrease, and hamstring and soleus the largest. Additionally, we found that tibialis anterior MEP showed no change during tSCS, immediately after, or post washout.

Conclusions: Our findings are consistent with previous studies on tSCS and spasticity. As expected, we saw an overall decrease in lower limb reflex amplitude with no change in MEP amplitude. These results suggest that afferent input to the motoneurons is being altered without changes in corticomotor excitability. Further, the long (15 minute) effect of stimulus likely arises from long-term neuromodulation.

Clinical Relevance: People suffering from neurological damage and spasticity experience difficulties with their ADLs. The current treatments for spasticity include pharmacological, positioning, stretching, and cyclic passive movement. Based on our results, tSCS offers a potentially effective intervention to diminish spasticity; especially in those experiencing hyperreflexia. Ultimately, this study shows that tSCS is a viable option for physical therapists to use in conjunction with other treatments to help reduce spasticity and return function to their patients.
ABSTRACT BODY:

**Purpose**: The purpose of this platform presentation is to describe an interdisciplinary intrathecal baclofen protocol for patients with Multiple Sclerosis (MS) who experience difficulty managing spasticity.

**Description**: For patients with MS who experience inadequate spasticity management with oral baclofen, intrathecal baclofen (ITB) may provide more effective management\(^1,2\). Approximately 13% of all patients with MS are candidates for an ITB pump; however, only one percent currently have an implanted pump.\(^1\) Upon collaborating with a model center for traumatic brain injury and spinal cord injury, our physical therapy department initiated an interdisciplinary protocol and education program for patients considering an ITB pump.

Over a two year period, five individuals were admitted for a one day ITB pump trial. The principal investigator (neurologist) obtained patient consent for a one time bolus of 50-100 micrograms of intrathecal baclofen at the L2 level. A physical therapist (PT) then provided patient education regarding study outcomes and pump placement. In addition, the PT performed baseline measurements of spasticity and function, including a Modified Ashworth Scale (MAS) and Tardieu Scale assessment of lower extremity tone, functional mobility rating using the Functional Independence Measure (FIM), Timed-Up and Go (TUG), and Two Minute Walk Test (2MWT).\(^7\) After baseline measures were completed, the neurologist administered the bolus injection. The PT repeated all outcome measures at 4 and 6 hours post-bolus injection. Based on the patient’s response, the PT provided recommendations to the neurologist for pump placement.

In addition to the pump trial protocol, a standardized exam and patient guidelines were developed. This included creating standardized communication between PTs and advanced practice partners across the patient care continuum.\(^6\) To ensure continuity of care, all rehabilitation staff was educated on the protocol.

**Summary of Use**: We successfully developed a standardized examination, assessment and follow-up communication to the baclofen pump trial and titration process. Through interdisciplinary communication, appropriate patient candidates were identified and effective titration of the newly placed pumps were achieved.\(^6\) Since protocol initiation, five patients completed a pump trial and three received a pump. One patient was lost to follow-up, and two made significant functional gains in FIM, TUG, 2MWT and MAS scores.

**Importance to Members**: This platform is designed to encourage other physical therapists to pursue creation of an interdisciplinary intrathecal baclofen pump program. This initiative demonstrates the importance of team communication to establish a patient centered and effective plan of care for individuals with an intrathecal baclofen pump.\(^3,4\) Finally, the physical therapist’s role in determining appropriate titration levels for optimal activity levels is highlighted.
TITLE: Vertical and Torsional Alignment Nulling: A Rapid Quantification of Binocular Misalignment without Recording Eye Movements

AUTHORS/INSTITUTIONS: M.C. Schubert, Johns Hopkins, Baltimore, Maryland, UNITED STATES|J. Millar, PMR, Johns Hopkins Medical Institutions, Odenton, Maryland, UNITED STATES|Y. Gimmon, Johns Hopkins University, Baltimore, Maryland, UNITED STATES|J.M. Serrador, War Related Injury and Illness Study Center, East Orange, New Jersey, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Patients with otolith pathology may have abnormal vertical or torsional ocular alignment, which is known to impair rehabilitation. We have developed a handheld, portable technology that uses a perceptual measure to quantify ocular misalignment upright and supine in order to discern otolith vs oculomotor pathology.

Vertical Alignment Nulling (VAN) and Torsional Alignment Nulling (TAN) tests were assessed for stability across hours and days, in addition to being assessed for differences in upright versus supine position across healthy control, patients with vestibular hypofunction (UVH), and veterans with multisensory impairment (MSI).

Number of Subjects: 9 controls, 20 patients with UVH, 9 veterans with MSI

Materials/Methods: Subjects view one red and one blue line on a tablet computer while looking through color-matched red and blue filters. Subjects align the red and blue lines, initially vertically offset from one another during VAN or rotated relative to one another during TAN, until they perceive a single continuous line. Ocular misalignments are inferred from residual offsets in the final line position. During testing, all binocular visual cues that would otherwise confound the misalignment results are eliminated by utilizing OLED technology and testing in a completely darkened room.

To date, 9 healthy control subjects, 20 patients with UVH, 9 veterans with MSI performed VAN and TAN in both upright and supine positions. Five of the healthy controls completed 20 trials each (upright and supine) once per hour, every 4 hours in 1 day; and separately once per day for 4 days. The patient subjects (UVH, MSI) and 4 healthy controls completed 1 set of VAN and TAN (20 trials each) in both upright and supine conditions.

Results: Both VAN and TAN were very stable within the same day and between different days with no significant differences (p>0.05). Patients appear to have similar mean scores for VAN (UVH 0.12 ± 0.64 deg upright; 0.19 ± 0.19 deg supine; MSI 0.06 ± 0.15 deg upright; 0.1 ± 0.15 deg supine) as healthy controls (0.12 ± 0.2 deg upright; 0.22 ± 0.24 deg supine). However, the patients appear to have supine TAN scores that are 2-3 times worse with greater variability (UVH 0.76 ± 1.41 deg; MSI 0.56 ± 2.34 deg) than healthy controls (0.19 ± 0.95 deg).

Conclusions: Our data suggest that the VAN and TAN ocular misalignment tests are stable across days and hours. Our preliminary data in patient subjects appears to suggest that supine TAN may be a better measure of ocular misalignment given the patients show a larger amount of error.

Clinical Relevance: If validated, the portable technology would be a valuable assessment tool for patients with vestibular, multisensory impairments. Having a rapid, non-invasive means to assess for proper ocular alignment will help ensure vestibular rehabilitation efforts are not impeded.

A future study to validate the tool in the concussion population could potentially prove relevant for assessment and rehabilitation of individuals with vestibular and oculomotor impairment on a broader scale.
Comparison of Patterns of Balance Loss following Perturbations in Standing for People with Multiple Sclerosis versus People with Parkinson's Disease

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Purpose/Hypothesis: Multiple sclerosis (MS) and Parkinson's disease (PD) typically result in balance difficulties that increase the risk of falling. However, differences in disease etiology and progression likely influence direction, type, and magnitude of loss of balance (LOB) following different environmental challenges. Patterns of LOB resulting from multi-directional external perturbations have not previously been examined in these populations. The purpose of this descriptive study was to examine patterns of LOB in people with MS compared to people with PD following standardized, anticipated, manual perturbations in different directions at the upper or lower torso. The hypotheses were that LOB patterns would differ between groups and following different directions and locations of perturbations.

Number of Subjects: 106 participants total: 64 with MS (mean age 54 (11)) and 42 with PD (mean age 68 (8)).

Materials/Methods: Participants experiencing mild to moderate disability and self-identified gait and balance difficulties were included. Each participant stood with feet together while the same therapist provided the same set of manual perturbations, including: quick nudges (4-6 lb. force) in the anterior/posterior (AP), and right/left (RL) directions at the shoulders (upper torso) and pelvis (lower torso). Amount of LOB following each perturbation was recorded on a 0-3 point scale grading magnitude and latency of movement at the trunk and feet. Prevalence indicated the number of perturbations with LOB in each direction. General Linear Model repeated measures compared LOB within and between the MS and PD groups with perturbations in each direction at the upper and lower torso.

Results: People with MS compared to those with PD had greater LOB in all directions, both amount and prevalence (main effect of group p<.001). In MS, LOB was greater posteriorly than anteriorly; in PD, LOB was greater anteriorly (interaction p<.001). In MS, there was no difference in LOB between upper and lower torso perturbations; in PD, LOB was greater with upper torso compared to lower torso perturbations (interaction p<.001). In both groups, LOB was greater with RL than AP perturbations (main effect of direction p<.001).

Conclusions: LOB differs between groups, with differences anteriorly/posteriorly, and with upper/lower perturbations. LOB is greater in the RL than AP directions in both groups.

Clinical Relevance: Clinicians may help reduce fall risk for people with MS or PD more effectively if they understand the differences in patterns of LOB for the two populations. These results can help clinicians target patient education and interventions to address the more challenging physical and environmental conditions for each diagnostic group. Personalizing intervention according to each individual's pattern of balance loss can potentially allay concerns about falling, improve mobility and optimize quality of life.
Title: The Lawton scale as a predictor of discharge destination in patients with stroke undergoing rehabilitation

Authors/Institutions: G.F. Marchetti, Physical Therapy, Duquesne University, Pittsburgh, Pennsylvania, United States| S.L. Whitney, Physical Therapy, University of Pittsburgh, Sewickley, Pennsylvania, United States| P.J. Sparto, Physical Therapy, University of Pittsburgh, Pittsburgh, Pennsylvania, United States| S. Abdulaziz, University of Pittsburgh, Pittsburgh, Pennsylvania, United States| N. Landgraff, Physical Therapy, Youngstown State University, Youngstown, Ohio, United States| E. Skidmore, Occupational Therapy, University of Pittsburgh, Pittsburgh, Pennsylvania, United States

Abstract Body:

Purpose/Hypothesis: Accurate prediction of outcomes following stroke rehabilitation is an important aspect of clinical care in terms of facilitating optimal services and minimizing cost associated with stroke rehabilitation. Assessment of activity limitations at the time of admission, including the Functional Independence Measure and the Barthel Index (BI), have been reported as significant predictors of discharge destination. In addition to these well-known measures of activity, the Lawton scale may also be a significant predictor of discharge destination, but it has not been researched for that purpose. Therefore, the purpose of this study was to examine the ability of the Lawton scale to predict discharge destination after stroke rehabilitation and to identify whether a subset of items at admission could predict discharge location.

Number of Subjects: Of 364 subjects, 210 (58%) had complete data on discharge destination and were eligible to be included in the study. Twenty-three subjects were excluded because they were discharged back to acute hospital settings. Analysis was based on 187 subjects.

Materials/Methods: A retrospective analysis of data obtained from charts of persons who had been admitted to rehab between 2004 and 2010 were analyzed. Variables collected at admission included patients' demographic data, clinical characteristics, and functional status. The Lawton scale was administered as part of the physical therapy assessment. The discharge destination was dichotomized as discharge to the community versus an institutional setting.

Results: Univariate analysis showed that the likelihood of discharge to an institution increased with a longer length of stay and increased stroke severity. Patients with better cognitive scores on admission and a high BI or Lawton score at admission were also less likely to be discharged to an institutional setting. Sub-item analysis of the Lawton scale showed that only one item, “telephone use,” was a significant predictor of discharge destination after stroke rehabilitation. However, neither the sub-item scores nor the total score of the Lawton scale were significant in the multivariate model. Only the basic activities of daily living (ADL), as measured by the BI, and stroke severity, as measured by the Orpington Prognostic Scale (OPS), were significantly associated with a higher risk of institutionalization.

Conclusions: Instrumental ADL, as measured by the Lawton scale, is not predictive of discharge destination in patients with stroke who are undergoing rehabilitation. The BI and the Orpington Prognostic Scale at the time of admission are the main predictors of discharge destination following inpatient rehabilitation in stroke survivors. In this sample, stroke severity contributed more to the prediction of the discharge destination than measures of basic functional status.

Clinical Relevance: Knowledge about the importance of these factors would allow for more successful clinical pathways that best meet a patient’s needs and minimize costs associated with inappropriate use of rehabilitation resources.
TITLE: Intensive robotic-assisted therapy over 2 consecutive “robocamps” is associated with walking benefits for an adolescent with right cerebral hemispherectomy: a Case Report.

AUTHORS/INSTITUTIONS: S. Kiseljak-Dusenbury, Don Knabe Wellness Center/Outpatient Physical Therapy, Rancho Los Amigos National Rehabilitation Center, North Tustin, California, UNITED STATES|S. Shaw, Neurology, Rancho Los Amigos National Rehabilitation Center, Downey, California, UNITED STATES|J.Y. Kasayama, R. Lewthwaite, Physical Therapy, Rancho Los Amigos National Rehabilitation Center, Downey, California, UNITED STATES

ABSTRACT BODY:
Background & Purpose: Cerebral hemispherectomy is a complete surgical resection and/or disconnection of one hemisphere performed to stop the detrimental effects of drug-resistant seizures on development. This surgery leads to severe hemiparesis and difficulty walking. The purpose of this case report is to evaluate the effectiveness of 2 consecutive intensive robotic-assisted therapy summer camps, called “robocamps”, for an adolescent, many years after cerebral hemispherectomy. Limited research supports the benefit of this therapy design for individuals functioning at a limited community ambulator status.

Case Description: Our participant was a 10-year old male, who had a history of large-scale spontaneous intracranial hemorrhage, at 2 weeks old, resulting in infantile spasms at 6 months old. At age 4, he underwent a right hemispherectomy. He presented to “robocamp” with left hemiparesis, decreased gait velocity, and limited walking endurance. He relied on a manual wheelchair for community mobility. He completed his first “robocamp” that consisted of 8 days of gait training (Hocoma Lokomat®) and ankle strengthening (inMotion ANKLE™) for 2 hours/day (camp 1). The next summer, our participant completed a repeated bout of this same protocol (camp 2). The camp-like setting also included upper extremity robotic therapy, recreation, and social activities (with others s/p hemispherectomy).

Outcomes: Mobility outcome measures included: 6-minute walk test (6MWT) and temporal-spatial gait analysis. Measurements were taken before and after each camp as well as the 6-month interval in between. At the start of camp 1, the participant’s walking endurance (23.8% N) and speed (38.1% N) was considerably limited compared to age-and sex-matched norm. Upon completion of both camps, he showed improvement for 6MWT and gait velocity with an overall 54% change in endurance and 177% change in his gait velocity. When referencing his results with Minimal Clinically Importance Difference (MCID = 34.4m for 6MWT,) that exists from the stroke population, he met MCID at 3 separate intervals throughout his participation in both camps. This included the interval between the start of camp 1 and the end of the camp 2 (87.2m). If categorized to adult stroke norms, he presented as a limited community ambulator at the start of camp 1 and approached unlimited community ambulator status by the end of camp 2. Also, there was a noticeable difference in the preferred mode of mobility, from wheelchair use at the start of camp 1, to ambulation at the end of camp 2.

Discussion: Consecutive bouts of intensive robotic-assisted walking therapy may be a promising program to improve endurance and velocity for patients s/p hemispherectomy. Our case study showed that with this therapy design, meaningful improvements can occur and be sustained even years past the acute recovery period. Further questions include whether combinations of therapies may have additional impacts on gait characteristics.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Title: Self-efficacy towards exercise in people with Parkinson’s disease who participate in a wellness retreat

Authors/Institutions: J. Charpentier, H. Lawler, E. Ulanowski, M. Danzl, Physical Therapy, Bellarmine University, Louisville, Kentucky, United States

Abstract Body:

Purpose/Hypothesis: Individuals with Parkinson’s disease (PD) potentially experience sedentary lifestyles, loss of mobility, and increased falls. They are also less physically active than peers without PD and physical activity declines at a faster rate. Exercise can improve quality of life and self-efficacy is directly related to exercise behavior in people with PD. Self-efficacy in those who sign up to participate in PD community-based wellness retreats is unknown. Do individuals sign up because they have high self-efficacy towards exercise already or do they have low self-efficacy towards exercise and are searching to become more confident? The purpose of this study is to examine self-efficacy toward exercise in people with PD who sign up to participate in a wellness retreat, as well as factors associated with self-efficacy.

Number of Subjects: 21 (10 males, 11 females; mean age 68 years (+9.98 SD); PD Hoehn and Yahr Stage 1-5)

Materials/Methods: For this cross-sectional descriptive study, participants completed the Self-Efficacy for Exercise Scale (SEES) and the Wellness and Physical Activity Questionnaire (WPAQ) prior to the retreat. Relationships were analyzed through correlational statistics. Nonparametric variables were analyzed with the Spearman’s rho and parametric variables were analyzed using Pearson’s Correlation Coefficient.

Results: Total SEES scores (mean,SD=57,17) revealed a wide disparity among participants with scores trending toward moderate to high self-efficacy. Several significant relationships (p<0.05) were found between SEE Scale data and participant characteristics from the WPAQ. Those with a higher total SEES score were more likely to spend more time exercising per week and think that a diagnosis of PD did not affect ability to perform physical activity. Those with a lower total SEES score were more likely to be older and think that their mindset about PD impacted a willingness to participate in physical activity. Factors that had no relation to the total SEES score were sex, years since initial diagnosis, Hoehn and Yahr Scale, amount of time exercising with others, hours of sleep, and number of days stressed in the past month. Item 8 on the SEES (asking how stress would affect confidence to exercise) was negatively associated with older age, a later stage of PD, and less sleep. Participants were less likely to exercise if they had to exercise alone (SEES item 4), if in a later PD stage, or if stress was not well controlled.

Conclusions: Self-efficacy toward exercise correlates with time spent exercising and a more positive mindset about the relationship between PD diagnosis and physical activity. Furthermore, factors such as age, stage of PD, sleep, and stress have relationships to self-efficacy.

Clinical Relevance: Clinicians can use this information to assess and address self-efficacy in those with PD. Continued development of community-based programs (e.g., wellness retreats) are needed to potentially increase self-efficacy with exercise.
TITLE: Gait, balance, and quality of life in a person with Parkinson’s disease following home training for larger arm swing: a case report


ABSTRACT BODY:
Purpose/Hypothesis: Parkinson’s disease (PD) leads to progressive neuromotor effects. In gait, these effects include decreased movement amplitude and velocity, changes in posture, and correlation with increased fall risk and decreased quality of life. Physical therapy targets these impairments with cues for proper movement, but retention can be challenging as improvements often dissipate when the cuing stops. Previous literature has shown that gait velocity, step length, and cadence change in response to cues for larger arm swing, but it is unclear how much training is needed for retention of these changes or whether there are associated changes in other domains such as balance or quality of life. The purpose of this work was to explore the immediate effects of ArmSense, a wrist-based vibratory cuing device to encourage larger arm swing, as well as retention of any changes after using the device for gait training at home. We hypothesized that after training, uncued gait would demonstrate retention of changes associated with the use of ArmSense. We also hypothesized that gait stability and PD-related quality of life would show improvement after training.

Number of Subjects: One female volunteer with PD (age 56, Hoehn and Yahr stage 2) with no additional neurological or orthopaedic diagnoses.

Materials/Methods: Two lab sessions (pre- and post-training) and 8 weeks of training between sessions were completed. Session 1 included uncued walking, walking with cues for a target arm swing of 120% of average uncued arm swing, a 5-minute rest, and more uncued walking. Home training included 3-5 walks per week, 30 minutes per walk, for 8 weeks. Session 2 included uncued over-ground and treadmill walking as in session 1. Step length, velocity, cadence, arm swing, interlimb coordination, trunk posture, Activities-Specific Balance Confidence Scale (ABC), United Parkinson’s Disease Rating Scale (UPDRS) motor function module, Dynamic Gait Index (DGI), and 39-item Parkinson’s Disease Questionnaire (PDQ-39) were analyzed. Wilcoxon rank sum tests were performed with Bonferroni corrections where needed to detect statistically significant differences between pre- and post-training.

Results: Comparing uncued walking before and after training, increases in step length (p=0.04), velocity (p=0.034), and arm swing amplitude (p<0.01) were seen after training. Arm-leg coordination was more normalized after session 1, but not after the training period. DGI and PDQ-39 scores improved, but not to a statistically significant level (p=0.15 and p=0.08, respectively).

Conclusions: Following gait training with arm swing cuing, individuals with Parkinson’s disease may demonstrate retention of gait changes, improved gait stability, and higher quality of life.

Clinical Relevance: Training for larger arm swing via a portable cuing device may lead to improved gait parameters even when cuing is withdrawn. Additionally, gait stability and quality of life may show improvements associated with cuing training, but more research is needed to further clarify and characterize these effects.
Objective: Walking backwards is essential to activities of daily living; individuals change directions during locomotion when maneuvering in their environment, such as opening a door, turning to sit down on a chair, or taking an item out of an oven. During these transitional movements, individuals must have proximal hip strength and dynamic balance to maintain mobility and avoid falls. With aging and vestibular pathology, an individual’s ability to perform backwards walking decreases, increasing risk for falls, and impacting ability to fully perform functional ambulation within the environment. Spatiotemporal changes of backwards walking have been shown to be more pronounced than forwards walking, especially with respect to gait velocity, stride length, step time, and cadence. Assessing backwards walking may be a biomarker to identify fall risk, especially with individuals that have difficulty integrating information from the vestibular, visual, somatosensory and musculoskeletal systems. Current clinical gait assessment fails to adequately capture an individual’s ability to perform backwards walking. The purpose of this study is to determine backwards walking speed references for the Functional Gait Assessment (FGA). The use of backwards walking time as a scoring criteria may influence the total score on the FGA and better identify fall risk. A secondary aim of this study is to provide norms based on age and gender for backwards walking.

Description: Healthy participants (n=49, 23-75 years old) walked with eyes opened, eyes closed, and backwards on a 20-foot pathway. Individuals with vestibular pathology (n=98, 30-79 years old) had no physical therapy treatment prior to performing the entire FGA. There were significant differences between individuals with vestibular pathology and those without on backwards walking time (healthy controls = 6.2 ± 2.4 s; vestibular pathology=14.2 ± 6.6 s).

Summary of Use: Cut-off scores were determined for backwards walking based on time for the FGA. It is recommended that normal ability is indicated by time less than 9 seconds, mild impairment is indicated by time less than 11 seconds, but greater than or equal to 9 seconds and moderate impairment is indicated by time greater than or equal to 11 seconds. Scoring for severe impairment would remain the same as in the original FGA description.

Importance to Members: Clinicians use the Functional Gait Assessment to determine fall risk. Due to the lack of objective criteria for backwards walking speed, therapists may score individuals higher, which would not identify the actual impairment. The published criteria for a score of 3 (normal) for backwards walking is “good speed”; for a score of 2 (mild impairment) is “slower speed”, and 1 (moderate impairment) is “slow speed”. The suggested time criteria for backwards walking may increase awareness to deficits in backwards ambulation, truly represent fall risk and ability to function independently.
**Title:** Understanding Motor Learning in Individuals with Multiple Sclerosis: Using Real-Life Task through Virtual Reality

**Authors/Institutions:** A. Al-Sharman, S. Khazaaleh, L. Abu Alfoul, Rehabilitation Sciences, Jordan University of Science and Technology, Irbid, Jordan | H. Khalil, Rehabilitation Sciences, Jordan University of Science and Technology, Irbid, Jordan | K. El-Salem, D. Al-Shorafat, Department of Neurosciences, Jordan University of Science and Technology, Irbid, Jordan

**Abstract Body:**

**Purpose/Hypothesis:** Multiple Sclerosis (MS) affects motor control and learning processes. Physiotherapists teach patients motor skills. Thus, it is mandatory to understand the extent to which people with MS can learn and retain improvements in their performance. Studies conducted to examine motor skill learning in MS have utilized simple tasks conducted on a computer. Most of the real-life tasks, however, are more complex in nature, longer in duration, and require reactions to environmental stimuli. Therefore, it is important to examine motor learning on such tasks. Virtual reality (VR) programs give the opportunity to engage in environments which appear and feel similar to real-world objects and events. This study used the VR to analyze motor learning in MS patients while practicing a novel motor skill.

**Number of Subjects:** Ten individuals with MS and 10 controls practiced weight-shift game that presented on a screen.

**Materials/Methods:** Participants need to move their bodies and avoid obstacles while keeping their balance. A pre-training test (1 trial), a training phase (4 trials), and a post-training test (1 trial) were administered. The number of correct points was calculated for each block. The difference between the pre-training and post-training was calculated for each group.

**Results:** The performance of both groups improved as indicated by an increase in the number of correct points achieved from pre-practice test to post-training test (3 ± 2.2 to 4.4 ± 1.4; 4.6 ± 2.4 to 7.6 ± 2.6, for individuals with MS and controls respectively). However, the magnitude of performance improvements of MS individuals was lower compared to controls.

**Conclusions:** Results demonstrate the intact ability to learn a novel motor skill in MS individuals. However, the extent of improvements were different between groups.

**Clinical Relevance:** Physical therapists are challenged to plan effective interventions that promote motor learning in individuals who undergo rehabilitation. Activity-focused motor interventions for individuals with disabilities emphasize the need for practice and repetition of purposeful motor actions to increase the individual’s participation in daily routines. MS individuals can benefit from interventions based on VR to improve motor learning skills through practicing complex challenging conditions that include aspects of cognitive loads.
TITLE: Daily acute intermittent hypoxia enhances self-selected walking speed in persons with chronic incomplete spinal cord injury

AUTHORS/INSTITUTIONS: A.L. Nogi, D.M. Peters, Y. Thibaudier, R.D. Trumbower, Division of Physical Therapy, Emory University, Atlanta, Georgia, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Regaining the ability to walk remains a high priority for persons with incomplete spinal cord injury (iSCI). Repetitive exposure to modest breathing bouts of low oxygen (acute intermittent hypoxia, AIH) is a non-invasive therapy that has been shown to induce walking recovery in both rodent models and persons with chronic iSCI. While gains in fast walking speed have been shown following daily (5 consecutive days) AIH alone, changes in self-selected walking speed and spatiotemporal parameters contributing to such improvements have not been explored. The purpose of this study was to assess changes in self-selected walking speed and spatiotemporal characteristics of gait after daily AIH in persons with iSCI, as gains in self-selected walking speed reflect decreased fall risk and improved energy efficiency of walking. Due to the positive relationship between stride length, single limb stance time and walking speed, we hypothesized that persons with iSCI would demonstrate increased self-selected walking speed following daily AIH and that this increase would correlate with increased stride length, decreased cycle duration, and decreased single limb support time.

Number of Subjects: Eight persons with chronic (>1 year) iSCI (average age=36.4±14.9 years; average time post-iSCI=7.5±6.9 years).

Materials/Methods: Subjects were randomized to first receive either daily AIH (FIO2=0.09) or normoxia (SHAM; FIO2=0.21) for 5 consecutive days, consisting of 15, 90-second hypoxic or normoxic episodes at 60-second normoxic intervals, with a 2-week wash-out period. Using a GAITRite walkway, self-selected walking speed and spatiotemporal parameters of gait were assessed at baseline, treatment day 5, and 10 days post-treatment.

Results: Self-selected walking speed increased after daily AIH alone relative to baseline (0.04±0.05 m/s, p=0.03), which translates to an average percent change of 12.82±15.80%; increases in self-selected walking speed were observed in 7 of 8 subjects, but did not persist at follow up. We also found complimenting spatiotemporal parameters that trended towards normalcy after AIH including decreased cycle duration, decreased single limb support time, and increased stride length. Although there was no difference in self-selected walking speed between AIH vs. SHAM (p=0.42), the minimal gains in self-selected walking speed following SHAM relative to baseline were not significant (0.01±0.02 m/s, p=0.24).

Conclusions: Results from this work offer evidence that daily exposure to mild AIH may enhance overground self-selected walking speed. These results compliment earlier findings that show daily AIH in combination with walking practice increases fast overground walking speed and offer promise for the use of AIH in locomotor restoration in persons with chronic iSCI.

Clinical Relevance: Slow walking speeds and impaired step timing and coordination are associated with increased fall risk in persons with iSCI. This is the first study to demonstrate AIH alone improves self-selected walking speed, which is important for safe, community mobility.
TITLE: Developing an App to Evaluate Upper Extremity Muscle Activation Patterns Following Spinal Cord Injury
AUTHORS/INSTITUTIONS: D. Beckham, G.R. Gustavson, E. Lewis, B.J. Farrell, Physical Therapy, Georgia State University, Atlanta, Georgia, UNITED STATES| S. Sinha Ray, W.B. McKay, Shepherd Center, Atlanta, Georgia, UNITED STATES

ABSTRACT BODY:
Purpose/Hypothesis: Following a spinal cord injury (SCI), the muscle activation patterns of the hand and forearm deviate from the typical patterns seen in the neurologically intact population. Recovery of hand and arm function is high priority for individuals with tetraplegia following spinal cord injury. Therapist delivered training can improve motor function more than spontaneous recovery alone. However, research is lacking in identifying an individual’s pattern after SCI and how to utilize those patterns to promote functional movement. The goal of this study was to compare muscle activation patterns from the forearm muscles of non-injured and SCI subjects. We hypothesized that [1] activation patterns would differ after SCI [2] that the app would reliably and consistently differentiate between muscle activation patterns of different actions.

Number of Subjects: 15

Materials/Methods: Twelve subjects without injury (NI group) and 3 subjects with incomplete cervical SCI (SCI group) were recruited for the study. Each subject performed three seated unilateral trials of sustained wrist flexion, wrist extension, making a fist, hand opening, radial deviation, and ulnar deviation while EMG data was collected from a low cost EMG armband around the subject’s forearm. Trials were then repeated contralaterally. Participants were provided verbal instructions, visual demonstration of the task, and sufficient time to practice the task before data collection. EMG patterns were compared using a vector similarity index (SI) to evaluate the movements with respect to the non-injured group.

Results: For the NI group, similarity index analysis could discriminate between most movements yielding reproducible and reliable results across subjects. Of the 3 antagonistic movements, wrist flexion and extension and wrist radial and ulnar deviation showed significant differences in SI. However, fist and open hand showed little difference in SI. Subjects with SCI demonstrated less pattern similarity compared to the NI group, which was reflected in their manual muscle tests.

Conclusions: Our hypothesis that muscle recruitment patterns could be differentiated across movements was held except in the case of fist and opening the hand. The results from our subjects with SCI support the use of a similarity index for muscle recruitment patterns and as the study is ongoing, additional SCI subjects will be enrolled for SI analysis.

Clinical Relevance: After SCI, functional independence is impacted by the degree of volitional hand and forearm impairment. This study provides initial data on forearm muscle activation patterns as altered following a SCI, which will be used in development of an app for clinicians to identify patient’s unique muscle activation patterns. This app should allow therapists to better identify improper or non-functional muscle patterns as well as provide a low cost at home training environment to supplement therapist training.
**Background & Purpose:** Benign paroxysmal positional vertigo (BPPV) is the most common diagnosis linked to complaints of dizziness. Anterior canal (AC) BPPV has the rarest occurrence rate and is estimated to occur in 1.2-12% of cases of BPPV. Research is inconclusive as to AC BPPV’s existence due to the anatomical alignment of the canals in the uppermost portion of the labyrinth. AC BPPV is defined by an ipsi-torsional, down beating nystagmus (DBN), in both dix-hallpike (DH) tests. AC BPPV may present as canalithiasis or cupulolithiasis, with differing diagnostic criteria to determine treatment. Cupulolithiasis is defined by otoconia attaching to the cupula, resulting in a non-fatiguing nystagmus without a latency period in DH testing. One of the accepted treatments for cupulolithiasis is the Liberatory maneuver, which utilizes acceleration to provoke movement of the otoconia through the canal. BPPV overall has a recurrence rate of approximately 50%, which is even higher in cases of AC BPPV and post-traumatic BPPV. This case presentation highlights successful treatment of a patient status-post concussion with AC cupulolithiasis with a Liberatory maneuver.

**Case Description:** The patient is a 51 year old male with past medical history of concussion and subsequent multi-canal BPPV. He successfully completed a course of therapy with two recurrences of BPPV during his care. He returned 6 months post-discharge with a complaint of vertigo. BPPV examination as observed through infrared video lenses revealed a non-fatiguing, right torsional, DBN in both DH tests, suggesting right AC cupulolithiasis. He was treated with 2-3 Liberatory maneuvers per session over 6 sessions. Education included self-assessment and self-treatment of AC BPPV due to patient's history of recurrence.

**Outcomes:** At discharge, there was no presence of nystagmus and patient was asymptomatic in all BPPV testing positions, suggesting resolution of AC cupulolithiasis. Functionally, he was asymptomatic with bed mobility and head movement in all directions. He reported reduced overall dizziness as noted with an improved score on the Dizziness Handicap Inventory from 26/100 to 0/100. He presented with improved confidence as noted with an increased score on the Activity Specific Balance Confidence Scale from 68.66% to 100% at discharge.

**Discussion:** This case presentation suggests that while AC BPPV is uncommon, appropriate equipment and nystagmus assessment during BPPV testing may allow for improved recognition of this condition. AC BPPV occurrence is considered rare given the canals' location and therefore does not often present in the clinical setting. In the case of a concussion, head trauma may indicate a special circumstance in which the occurrence of AC BPPV may be increased compared to the general population. As noted in this case, AC BPPV should be considered when a torsional DBN is present in both DH tests. This case study supports the successful diagnosis and resolution of AC cupulolithiasis using the Liberatory maneuver.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

TITLE: Progressive Muscle Relaxation, Mindfulness, Meditation, and Mental Practice-based interventions for the treatment of Tremor after Traumatic Brain Injury

AUTHORS/INSTITUTIONS: A.L. Hall, K. Barta, M. Sawtelle, Physical Therapy, University of St. Augustine for Health Sciences, Austin, Texas, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Individuals post-TBI are likely to experience cognitive, sensory, and motor impairments. Tremor is a common movement disorder that can affect this patient population. Currently, no consensus has been reached on the most effective means of tremor treatment. The purpose of this case report was to describe the effects of progressive muscle relaxation, mindfulness, meditation, and mental practice-based interventions on persistent right upper extremity tremor in a patient post traumatic brain injury (TBI).

Case Description: The patient was a 47-year-old male with deficits in cognition, sensation, proprioception, balance, and motor function secondary to an open-TBI ten years prior. A resting and postural tremor of the right distal upper extremity developed approximately two years after the date of injury which persisted and progressed despite conventional interventions. The patient’s primary goal for therapy was to decrease tremor severity, in order to improve his ability to perform activities of daily living. A major concern verbalized by the patient was the social stigma that prevailed in social situations as a result of the progressive tremor.

Outcomes: Progressive muscle relaxation, mindfulness, meditation, and mental practice-based interventions were provided one hour a week for five weeks in order to target tremor severity through the stimulation of a parasympathetic nervous system response. Additional active range of motion activities, an audio based home meditation and muscle relaxation program and patient education on mindfulness were also performed at least twice per day.

Outcome measures related to self-perceived tremor severity, upper extremity functional ability, and muscle activation were taken on evaluation and following five weeks of intervention. Marked improvements were noted with the Quality of Life in Essential Tremor (Quest) questionnaire demonstrating a 27.7% decrease related to physical function, a 22.22% decrease related to self-image and social interaction, a 16.67% decrease related to participation in hobbies and an 8.33% decrease related to verbal communication. Self-perceived and measurable gross manual dexterity improvements were noted by a four point increase in the ABILHAND questionnaire and a three point improvement in the box and block test. Follow up electromyographic (EMG) values yielded 1.33e-5mV and 2.49e-5 mV decreases in muscle activation respectively during both finger to nose and outstretched arm tasks. Tremor frequency also decreased from 3.4/sec to 2.6/sec following intervention.

Discussion: Outcomes from this case report suggest that a multimodal approach using a combination of progressive muscle relaxation, mindfulness, meditation, and mental practice-based interventions may contribute to a decrease in chronic tremor in patients with TBI. Further investigation is needed to verify these claims.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Effect of brief intensive robotics-assisted therapy on improved walking endurance many years after cerebral hemispherectomy.

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Purpose/Hypothesis: Cerebral hemispherectomy is an effective treatment option for those with medically intractable epilepsy. Many regain the ability to walk after this surgery but most have difficulty advancing and stabilizing the hemiparetic limb. Research is limited in determining the effectiveness of rehabilitative techniques after hemispherectomy, especially years after the surgery. At a chronic phase in this population’s recovery, we propose that high-intensity daily robotic-assisted training, in an enriched camp-like setting, would be an effective tool to improve walking ability after hemispherectomy.

Number of Subjects: 7 Adolescents (5 female) with an average of 7 years post hemispherectomy (range: 3-12 years), and a mean age of 11 years (range: 10-12 years).

Materials/Methods: Participants received 8 days of gait training (Hocoma Lokomat®) and ankle strengthening (inMotion ANKLE™) for a total of 2 hours per day. They also received upper extremity robot-assisted training (InMotion ARM™), 1 hour per day. Interventions occurred in a day-camp setting, where participants received robotic-assisted therapy, enriched recreational tasks, and social activities over 2 weeks. Pre-Camp, Post-Camp, and 6-month follow up outcome measures included: 6-minute walk test (6MWT) and GaitRite electronic walkway® derived gait velocity, cadence, step length, stance time, swing time, BOS, and toe in/out.

Results: Increases in 6MWT (p=0.048) were significant but gait velocity did not change significantly (p=0.323). Participants increased their distance on the 6MWT from pre- to post-camp (341.7 ± 48.64 to 391.5 ± 43.95; p = 0.048) and sustained these increases to the 6-month follow-up (402.82 ± 41.19, p = 0.642). No significant differences were noted for all other temporal-spatial gait characteristics.

Conclusions: Our participants’ walking endurance at enrollment was considerably limited (27.6% N) compared to healthy, age-matched norms. Results of the study suggest that a high-intensity, robotic-assisted intervention in a camp-like setting may be a promising method of improving walking endurance for adolescents years after hemispherectomy.

Clinical Relevance: Increasing walking endurance is important for physical competence and social acceptance for full participation. Physical therapy treatment plans for patients with this diagnosis should include endurance training especially if baseline scores are very low. Sample size increases, with focus on etiology classifications, and/or modification of this protocol to include traditional or other therapies may be needed to determine if meaningful effects on other gait characteristics are achievable.
TITLE: Carry-over effects of vibrotactile feedback on long-term balance training in people with peripheral neuropathy: a case series

AUTHORS/INSTITUTIONS: K.H. Sienko, Mechanical and Biomedical Engineering, University of Michigan, Ann Arbor, Michigan, UNITED STATES|W.J. Carender, Otolaryngology, University of Michigan Health System, Ann Arbor, Michigan, UNITED STATES|S.L. Whitney, Physical Therapy, University of Pittsburgh, Sewickley, Pennsylvania, UNITED STATES|B. Klatt, Physical Therapy, University of Pittsburgh, Pittsburgh, Pennsylvania, UNITED STATES|T. Bao, University of Michigan, Ann Arbor, Michigan, UNITED STATES|C. Kinnaird, University of Michigan, Ann Arbor, Michigan, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: People with peripheral neuropathy have increased incidence of chronic balance impairments and fall risk. Vibrotactile feedback has been shown to improve gait and plantar pressure distribution in people with peripheral neuropathy, but the long-term carryover effects following the use of vibrotactile feedback to improve balance is unclear. Participants who completed the balance training protocol were hypothesized to show improved balance and decreased fall risk (vibrotactile feedback group more so than the control group).

Number of Subjects: 4

Materials/Methods: Four participants (2 females, mean age 68 years old (± 2 SD), with the diagnosis of peripheral neuropathy completed an 18-session balance training protocol. Three participants were in the experimental vibrotactile feedback group (VTF1, VTF2, VTF3) and one participant was in the control group (CTRL). Objective functional outcome measures were compared at baseline, post-training, and six months post-training.

Results: Baseline to post-training scores (* indicates clinically meaningful change). Gait Speed: (VTF1) 0.7 to 0.81m/sec*; (VTF2) 1.15 to 1.45m/sec*; (VTF3): 0.6 to 0.7m/sec*; (CTRL): 0.84 to 1.05m/sec*. DGI: (VTF1) 15 to 18/24*; (VTF2) 22 to 24/24; (VTF3): 12 to 14/24; (CTRL): 15 to 18/24*. FGA: (VTF1) 13 to 17/30*; (VTF2) 24 to 30/30*; (VTF3): 11 to 14/30; (CTRL): 16 to 17/30. SOT: (VTF1) 36 to 49*; (VTF2) 72 to 75; (VTF3): 38 to 52*; (CTRL): 43 to 51*. Mini-Best: (VTF1) 13 to 15/28; (VTF2) 24 to 26/28; (VTF3): 12 to 18/28; (CTRL): 18 to 20/28. There was no statistical significance of functional outcome improvements between groups following training. The following changes were observed when comparing immediate post-training to six-month post training scores in points (pt): DGI (VTF1) 6-pt loss; (VTF2) 4-pt loss; (VTF3) no change; (CTRL) 2-pt loss. FGA (VTF1) 4-pt loss; (VTF2) 3-pt loss; (VTF3) 2-pt loss; (CTRL) 1-pt loss. SOT (VTF1) 12-pt loss; (VTF2) 4-pt gain; (VTF3) 8-pt loss; (CTRL) 9-pt gain. Mini-Best: (VTF1) 1-pt loss; (VTF2) no change; (VTF3) no change; (CTRL) 1-pt loss. Gait speed (VTF1) 0.12m/sec slower; (VTF2) 0.2m/sec slower; (VTF3) 0.09m/sec slower; (CTRL) 0.06m/sec slower.

Conclusions: Following the balance training protocol, all participants (n=4) showed a clinically meaningful improvement in gait speed. Improvements were noted in all functional outcome measures from baseline to post-training. The participants receiving vibrotactile feedback(n=3) had greater improvements in functional gait assessment scores immediately following training compared to the control group. At the six-month post assessment, the observed scores trend towards returning to baseline.

Clinical Relevance: Balance training had a positive effect on objective outcome measures for all participants with peripheral neuropathy. Vibrotactile feedback is a modality that may further improve training outcomes and support telerehabilitation applications for people with chronic balance impairments.
TITLE: Feasibility of Wearable Technology for Guided Dance in People with Parkinson’s Disease: A Pilot Study

AUTHORS/INSTITUTIONS: A. DeBlois, E. Yates-Horton, S. Asher, E. Clipston, E. Kraut, Upstate Medical University, Syracuse, New York, UNITED STATES|L. Columna, Syracuse University, Syracuse, New York, UNITED STATES|T. Tunur, California State University San Marcos, San Marcos, California, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Wearable technology has increased opportunity for physical activity. However, dual task demands which wearable technologies place on the user need to be considered due to potential fall risk implications. The purpose of this pilot study was to determine the feasibility of using Google Glass (GG) customized with guided dance modules developed by the Mark Morris Dance Group and SS+K for individuals with Parkinson’s Disease (PD). Previous PD research has demonstrated both motor and non-motor improvements with interventions such as dance and has supported the feasibility of GG providing external auditory cues to improve gait.

Number of Subjects: 7

Materials/Methods: This cohort study included seven participants with idiopathic PD, 3 males and 4 females, mean age 69 years old (+/- 5.5), Hoehn and Yahr (H&Y) 1-3, mean MDS-Unified Parkinson’s Disease Rating Scale (MDS-UPDRS) motor scores of 42 (+/- 9.18), and Montreal Cognitive Assessment (MOCA) score >21. Participants were interviewed and screened with the MOCA on the first visit. The second visit included assessment with Activities-specific Balance Confidence Scale (ABC) and Mini-BESTest and instruction with GG with Moving Through Glass (MTG) application. All participants demonstrated competency with MTG modules (Warm Me Up, Balance Me, Unfreeze Me, and Walk with Me) and were instructed to use the MTG via GG at least once daily, and log usage. After three weeks of using MTG, participants returned for post-intervention assessments (ABC and miniBESTest) and an exit interview. Statistical analysis was performed using JMP Software (SAS Institute) including Spearman’s Rho for correlation of assessments with device usage and Paired T-tests for pre/post assessments.

Results: This pilot data demonstrates that although three of seven participants were at risk for falls based on their ABC or Mini-BESTest performance at baseline, and all seven participants subjectively reported balance impairments, no falls or injury were reported during use of the device. There was no significant correlation between balance confidence (ABC, p=0.18) or balance performance (mini-BESTest, p=0.28) and number of times MTG was used within the three weeks. Paired T-tests showed no significant difference between pre/post ABC (p=.74) and miniBESTest (p=.735). Retrospective power analysis indicated n >450 subjects for adequate power to detect significant difference. Preliminary review of usage logs suggests the MTG via GG was a motivating factor to increase physical activity.

Conclusions: MTG via GG technology may be a safe option for guided dance for individuals with PD. Further research is needed with a larger sample size to more fully assess the safe use of this technology. More specific parameters of use are also needed to determine any possible effects on physical performance over time.

Clinical Relevance: Physical activity for individuals with PD is vital. Guided dance delivered by wearable technology may be a safe adjunct to traditional exercise methods in those with PD, even those with balance impairments at risk for falls.
TITLE: The Extent of the Relationship between Sleep Disturbances and Walking Ability in People with Multiple Sclerosis

AUTHORS/INSTITUTIONS: A. AL-SHARMAN, Rehabilitation Sciences, Jordan university of science and technology, Irbid, JORDAN|H. Khalil, rehabilitation sciences, Jordan university of science and Technology, Irbid, JORDAN|K. El-Saleh, department of neurology, Jordan University of Science and Technology, Irbid, JORDAN|D. Al-Shorafat, department of neurology, Jordan University of Science and Technology, Irbid, JORDAN|H. Dawes, P. Esser, Oxford Institute of Nursing and Allied Health Research, Oxford Brooks University, United kingdom, UNITED KINGDOM

ABSTRACT BODY:
Purpose/Hypothesis: Multiple sclerosis (MS) is a multi-focal progressive disorder of the central nervous system that results in diverse clinical manifestations including walking difficulties. Despite the fact that disturbances of sleep are among the most common and disabling manifestation of MS, no study has examined the association between sleep quality and mobility measures. Previous studies suggested that sleep deficits provoke cognitive changes, fatigue and depression. Because these factors have been associated with unsafe walking, we hypothesized that sleep deficits are associated with poorer walking in people with MS. Thus, the aim of this study was to examine the relationship between sleep quality and gait parameters in individuals with MS.

Number of Subjects: 38 participants with relapsing remitting MS were evaluated.

Materials/Methods: An observational cross-sectional design was used in this study to explore the association between sleep disturbances and gait measures. 38 participants with relapsing remitting MS were evaluated. Gait was assessed using an inertial measurement unit. Sleep status was evaluated using the Pittsburg Sleep Quality Index (PSQI) as well as objective measures derived from sleep monitor (Acti-watch).

Results: 38 subjects completed the assessment in this study (mean ± SD, 36.0±9.2 years; 6.5±2.5 units in EDSS scale). All participants reported poor sleep quality (PSQI >5). Sleep efficiency and waking after sleep onset (WASO) as measured by acti-watch were significantly correlated with stride length (R=0.34, p=.03; R= -0.37, p=0.02, for sleep efficiency and WASO, respectively). Sleep latency were found to negatively correlated with stride length standard deviation a reflection of gait variability (R= -0.37, p=0.02)

Conclusions: Poor sleep quality was found to be associated with reduced stride length and increased stride length variability

Clinical Relevance: Sleep assessment should be considered for MS individuals. Intervention that could improve sleep quality and consequently improve gait performance and quality of life should be considered.
Title: Test-Retest Reliability and Minimal Detectable Change for Measures of Gait and Balance in Adults with Cerebral Palsy


Abstract Body:

Purpose/Hypothesis: Walking often deteriorates in ambulant adults with cerebral palsy (CP) in early adulthood. Decline in walking propagates a downward spiral by imposing a more sedentary lifestyle, increasing falls risk, negatively affecting health status, participation and quality of life, and ultimately resulting in increased disability. Deterioration in balance is often reported to be associated with the decline in walking. Present evidence is not sufficient to guide interventions aimed at improving gait and balance in this population. To advance research in this area, there is a need for measures of balance and gait with known psychometrics for adults with CP. The goal of this study is to establish estimates of test-retest reliability and MDC values for: (i) Balance Evaluation Systems Test (BESTest); (ii) Four Step Square Test (FSST); (iii) Activities-specific Balance Confidence (ABC) Scale and Modified Fall Efficacy Scale (MFES); and (iv) Spatial-temporal gait parameters using an electronic walkway.

Number of Subjects: 17

Materials/Methods: A convenience sample of 17 ambulant adults with CP ages 19-50 yrs (average 33, SD=8.7); 5 males, 12 females; 5 classified as GMFCS I and 12 classified as GMFCS II were tested in a human movement laboratory. Balance performance was assessed using the six sections of the BESTest and the FSST; balance confidence and falls efficacy were assessed using the ABC and the MFES respectively. Gait spatial-temporal data at self-selected comfortable gait speed (CGS) and fast gait speed (FGS) were collected as participants performed four passes on a 16-ft electronic walkway. Test-retest reliability values were estimated using intraclass correlation coefficients. Minimal detectable change (MDC) values were calculated using standard error of measurement (derived from ICC and pooled SD).

Results: Participants completed 2 similar testing sessions within an average of 10.4 days (SD=4.8). The test-retest reliability values (ICC(2,1) at alpha=0.05) were: ICC(BESTest)=0.99, ICC(BESTest sections) ranged from 0.85 to 0.99; ICC(FSST)=0.92; ICC(ABC)=0.75 and ICC(MFES)=0.83; ICC(CGS)=0.88, and ICC(FGS)=0.96. The MDC values were: 5.4 points for BESTest total, MDC for BESTest sections ranged from 1.1 to 4.5; 2.7 sec. for FSST; 19 points for ABC (on a scale of 0-100) and 1 point for the MFES (on a scale of 0-10); and 0.27 m/s for CGS, and 0.21 m/s for FGS.

Conclusions: Most outcomes had excellent (ICC≥0.9) or good (ICC=0.8 to 0.89) test-retest reliability in this small sample of ambulant adults with CP. ABC had a moderate test-retest reliability. Further research is needed to determine the magnitude of change required for clinical significance.

Clinical Relevance: These measures can be useful to evaluate gait and balance in the clinic in this population. MDC values can help evaluate whether observed changes exceed expected variations that are due to experience and inherent human variation in performance. ABC questionnaire should be used with caution considering the moderate ICC and the large MDC values.
ABSTRACT BODY:

Purpose/Hypothesis: Studies indicate stroke survivors are more sedentary than age-matched counterparts and are at risk for a secondary stroke. Researchers have identified self-efficacy as the strongest determinant of intention to increase physical activity. Studies using pedometers and accelerometers to promote physical activity have shown that having a step goal is another key factor. It is hypothesized activity trackers may be a tool for improving physical activity following stroke. The primary purpose of this study was to compare the impact of individualized activity tracker feedback to individualized activity tracker feedback plus online peer support on walking activity post-stroke. The secondary purpose was to evaluate how physical activity beliefs and feedback preferences of individuals’ after stroke affect responsiveness to activity tracking.

Number of Subjects: 10

Materials/Methods: Chronic stroke survivors wore a Fitbit Flex™ for 10 weeks. Group A (n=7) received individual followed by group step activity feedback. Group B (n=3) received group followed by individual step activity feedback. Groups completed a 2 week baseline and washout before each 3 week intervention. For both interventions, subjects were given a goal to increase their daily step activity by 25% and could monitor their progress with the Fitbit. For the group feedback intervention, subjects could interact and compare their daily step activity through the Fitbit application. A convenience sample (n=4) participated in audio recorded semi-structured individual and focus group interviews. Qualitative data was examined using a phenomenological approach to explore attitudes/beliefs about physical activity and utilization of activity tracker feedback.

Results: The primary outcome was average number of daily steps. For all subjects, a significant difference was found between baseline and 1st intervention (X2=12, p=0.007, % increase= 37), but a significant difference was not found between 2nd intervention and wash-out (Z=-.153, p=.878) or wash-out and 2nd intervention (Z=-1.274, p=.203). There was no significant difference between Group A and Group B at baseline (U=3, Z=-1.71, p=.087), 1st intervention (U=8, Z=-.57, p=.569), washout (U=8, Z=-.57, p=.569), or 2nd intervention (U=10, Z=-.114, p=.909). Preliminary analysis of qualitative data revealed subjects liked seeing their step count but chose not to use the group features even though they knew how to do so.

Conclusions: On average, subjects increased daily steps by 37% during the 1st intervention, exceeding the step goal of 25%. Qualitative data concerning feedback preferences supports quantitative data which suggests no added benefit of online peer support to individualized feedback. A lack of relationship between subjects may have resulted in underutilization of group feedback.

Clinical Relevance: A Fitbit may be a tool to improve daily step activity for individuals with chronic stroke. It may be beneficial to use interviews to determine readiness for change and if individuals would benefit from feedback and goals set with step activity monitoring.
TITLE: The Effect of Music on Gait Pattern for Patients with Parkinson’s Disease

AUTHORS/INSTITUTIONS: J.L. Guzman, M. McEwen, R. Cooper, Physical Therapy, UNTHSC, Fort Worth, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Reports have shown that music therapy can help patients with Parkinson’s Disease who often demonstrate difficulty ambulating. However, it is unclear how music therapy can benefit this patient population. The purpose of this systematic review is to identify specific music therapy parameters used such as genre of music, frequency, and length of intervention and analyze how each were implemented to improve ambulatory ability in patients with Parkinson’s Disease.

Number of Subjects: Nine studies met the inclusion criteria. Of the nine studies, there were 263 subjects with Parkinson’s Disease with a Hoehn and Yahr score range of I-III.

Materials/Methods: Three researchers conducted search through PubMed resulting in nine applicable articles in the last ten years which included two systematic reviews, six randomized control trials, and one cohort study. Inclusion criteria included 1) subjects with Parkinson’s Disease; 2) ambulatory without physical assistance; and 3) community dweller. Exclusion criteria are visual or auditory deficits.

Results: Music genre used in these studies were Renaissance (4 studies), Classical (1 study), German folk (3 studies), jazz (1 study) and music with an underlying metronome beat (3 studies). The most frequently used type of music was instrumental with a definitive beat (6 studies) that was familiar to the subject (3 studies), resulting in significant improvements in gait stride, cadence, and step length (9 studies). Music was delivered via headphones (5 studies) or speaker (1 study). Compared to their gait speed baseline (GSB), subjects performed best when the music frequency was increased by ten percent (5 studies). One of the most important factors of music therapy is the use of familiar music, which results in minimal cognitive demand to synchronize gait (4 studies). In terms of parameters, the length of each intervention session lasted 30-60 minutes with 30 minutes being the most often used (seven studies); the frequency was one to 3 times per week with three times per week as the most selected (5 studies); and the entire duration of the therapy ranged from 1-13 weeks with 3 weeks as the most common.

Conclusions: The quality of music that will promote gait initiation and improve gait parameters in patients with Parkinson’s Disease include the following: familiarity, instrumental music, definitive beat, headphone delivery, and GSB increased by ten percent. The most common selected intervention parameters are 30 minute sessions, 3 times per week, for 3 weeks.

Clinical Relevance: This systematic review establishes appropriate dosing of music therapy and the optimal mode of delivery for gait training in order to see the largest improvement in cadence, stride length, and step length, thus reducing fall risk.
Purpose/Hypothesis: The ability to coordinate movements between the arms in bimanual tasks is crucial for participating in daily activities. One common bimanual task is where two arms share a single and united goal (common-goal) whereas another type of bimanual task involves separate goals for each arm (dual-goal). It remains unclear if the neural mechanisms underlying these two types of bimanual tasks differ. The purpose of this study is to examine the neuromotor control of bimanual actions constrained by a common-goal, bimanual actions driven by separate goals (dual-goals), and unimanual conditions in terms of task performance and cortical mechanisms.

Number of Subjects: 11

Materials/Methods: Eleven right-handed participants performed isometric force matching tasks at 10% of their maximal voluntary contraction (MVC) in three conditions: 1) bimanual common-goal condition, 2) bimanual dual-goal condition, and 3) unimanual condition. Paired-pulse transcranial magnetic stimulation (TMS) was used to assess the intracortical inhibitory modulation (short-interval intracortical inhibition, SICI) of both hemispheres during each condition. The force performance of both arms, including interlimb force correlation and force variability, was evaluated and compared between common-and dual-goal conditions.

Results: Our results showed a reduction in SICI in both hemispheres during the dual-goal compared to unimanual conditions (P=0.001) whereas a reduction of SICI was seen in the dominant hemisphere only during the common-goal compared to unimanual conditions (P=0.02). This suggests that different neural control strategies may be adopted between these two types of bimanual tasks. Two interlimb force coordination patterns were identified. A greater proportion of negative interlimb correlation was found in common compared to dual-goal tasks (P=0.012), indicating that a give-and-take strategy was utilized when the two arms have a common goal. Additionally, we found that control of the non-dominant arm affected the stabilization of overall bimanual force performance in the common-goal task (P=0.002). In contrast, for the dual-goal task, both arms were coupled together but in a positive manner.

Conclusions: Our study demonstrated that neural motor control mechanisms may differ between bimanual common-vs. dual-goal tasks even when the motor task itself is identical. In particular, the control of the non-dominant arm may be critical when both arms have a single and united goal.

Clinical Relevance: The ability to restore coordination between the arms is critical for regaining functional independence for individuals after neurological injuries such as stroke. This study provides evidence that neuromotor control mechanisms may be different based on the goal conceptualization of bimanual tasks, indicating that bimanual motor training approaches should be designed according to specific task demands of a bimanual task.
TITLE: Assessing the influence of cognitive training and physical exercise on mechanisms of plasticity and static balance in individuals post-stroke.

AUTHORS/INSTITUTIONS: J. Rice, Physical Therapy, University of Miami, Miami, Florida, UNITED STATES| S. Aldraiwiwesh, J. Gomes-Osman, Physical Therapy, University of Miami Miller School of Medicine, Coral Gables, Florida, UNITED STATES

ABSTRACT BODY:
Purpose/Hypothesis: To compare the effect of a 12-week program consisting of either combined aerobic and resistance exercise training (CARET), or the association of CARET and a cognitive training intervention (CTI) (CARET+CTI) on mechanisms of plasticity and measures of static in individuals post stroke. We hypothesized that CARET+CTI would be associated with greater improvements in mechanisms of plasticity and static balance compared with CARET.

Number of Subjects: Seven subjects.

Materials/Methods: Subjects fulfilled the following criteria: diagnosis of ischemic or hemorrhagic stroke, Modified Rankin Score of <4, sedentary prior to stroke, ability to walk ≥10 meters with or without assistance, and no absolute contraindications to receiving transcranial magnetic stimulation (TMS). Subjects underwent an assessment of mechanisms of plasticity and static balance before and after the intervention. After the pre-test assessment, subjects were randomized to receive either CARET only (45 to 60 minutes at approximately 60 percent of the heart rate max) (n=3) or CARET+ a computer based CTI for 30 minutes (n=4) for 3x/week for 12 weeks. Mechanisms of plasticity were assessed by comparing motor evoked potential (MEPs) amplitudes obtained from single TMS pulses prior to (baseline) and 10 minutes following intermittent theta-burst (iTBS) (T10). Plasticity was operationally defined as a percent change in MEP’s at T10 compared to baseline. For the static balance assessment, subjects were fitted sensors containing accelerometers (Mobility Lab APDM, Inc), and performed quiet standing balance tests in three conditions (eyes opened, eyes closed, and dual-task utilizing a serial 7 subtraction test). Total sway area was (TSA) used to measure static balance.

Results: Subjects in the CARET+CTI group demonstrated increased iTBS-induced facilitation of MEP responses from pretest to post test compared to CARET only group (4/4 vs. 1/3, respectively). The mean change in TBS-induced modulation of MEP responses was 68.3% in the CARET+CTI group, compared to -23.4% in the CARET group. Mean change in TSA during eyes open was $0.009122 \text{ m}^2/\text{s}^{5}$ for CARET+CTI and $0.004725 \text{ m}^2/\text{s}^{5}$ for CARET. Mean change in TSA during eyes closed was $0.002159 \text{ m}^2/\text{s}^{5}$ for CARET+CTI and $0.002179 \text{ m}^2/\text{s}^{5}$ for CARET. Mean change in TSA during dual-task was $-0.00271 \text{ m}^2/\text{s}^{5}$ for CARET+CTI and $0.003576 \text{ m}^2/\text{s}^{5}$ for CARET.

Conclusions: The results of the present study suggest that 12 weeks of either aerobic exercise combined with cognitive training, or aerobic exercise alone may be associated with different patterns of plasticity measured by TMS and iTBS in people post-stroke. In addition, these interventions as administered in the present study, seem to be associated with similar patterns of static balance.

Clinical Relevance: Assessing the effects of a regular exercise regimen on brain plasticity is useful to further examine the mechanisms mediating cognitive performance improvements in humans, potentially increasing the specificity of exercise prescription.
TITLE: The effect of transcranial direct current stimulation on ankle torque production when delivered with two different electrode montages.

AUTHORS/INSTITUTIONS: K. Perkins, D. Blancett, T. Graham, R. Young, C. Lairamore, Physical Therapy, University of Central Arkansas, Conway, Arkansas, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Transcranial direct current stimulation (tDCS) is a non-invasive neuromodulatory technique that has been found to alter the resting membrane potentials within the cerebral cortex. However, the majority of the literature regarding tDCS focuses on its effects on upper extremity function. As the lower extremity (LE) motor cortex is located closer to midline and deeper, more research is needed to investigate the best methods for delivering tDCS to this area of the brain. This study examines the effect of tDCS delivered with two different electrode montages (M1-SO and C1-C2) on LE torque production. The purpose of this study was to test the hypothesis that ankle dorsiflexion and plantarflexion will demonstrate an increase in torque production immediately following tDCS compared to sham, and to investigate if one electrode montage is superior.

Number of Subjects: 12 healthy subjects, 6 females and 6 males, 22-31 years old.

Materials/Methods: A repeated measure within subject design was employed. Each subject received each condition of tDCS in a randomized sequence with a week wash out period. For the C1-C2 montage the anode was placed over C2 (based on the international 10-20 EEG system) and the cathode was placed at C1. For the M1-SO montage and sham conditions the anode was placed over C2 and the cathode was placed supraorbitally over the left eye. 10-20 EEG gel was used as a conductive medium for all conditions. For the two active conditions, tDCS was delivered for 15 minutes at 2.0 mA. Sham tDCS was performed for 15 minutes with a 2.0 mA ramp up for the first 30 seconds, then dropped to 0.0 mA. A pre-test post-test sequence was implemented with each tDCS intervention. Lower extremity dorsiflexion/plantarflexion strength testing was completed using the Biodex model 840-140. The isometric testing set consisted of 6 repetitions of maximal isometric contraction held at -15° for 3 seconds with a 12 second rest between each repetition. Next, isokinetic dorsiflexion and plantarflexion was tested. Three repetitions were completed at a speed of 60°/second with a 30 second relaxation period between sets.

Results: Mixed model ANOVAs revealed no significant difference (p>0.05) between pre and post testing nor between both active tDCS conditions and sham stimulation for all dependent variables. Analyses revealed a power of .593 for isometric dorsiflexion, a power of .448 for isokinetic plantarflexion, and a power of .646 for isokinetic dorsiflexion.

Conclusions: When applying tDCS to healthy adults, neither the C1-C2 nor the M1-SO electrode montages produced an increase in torque for non-dominant ankle dorsiflexion or plantarflexion when compared to sham stimulation. Suggestions for further research include an increase in sample size in order to increase statistical power of the study and recruitment of non-healthy participants to eliminate possible ceiling effects.

Clinical Relevance: Additional research is recommended prior to clinical use of tDCS as a means of increasing lower extremity torque.
ABSTRACT BODY:

Purpose/Hypothesis: The purpose of this study was to 1) compare outcomes of participants with traumatic brain injury (TBI) and stroke (CVA) who participated in a post-acute brain injury rehabilitation (PABIR) program, and 2) determine if admit Disability Rating Scale (DRS) and Supervision Rating Scale (SRS) scores can be predictive of discharge scores in both etiologies.

Number of Subjects: N=289 (TBI=121, CVA=168)

Materials/Methods: Retrospective study of participants with TBI or CVA admitted to a PABIR from 5/2008 to 5/2016. Individuals either participated in a combined program of coordinated inpatient and outpatient care (N=134) or were discharged from the inpatient program and sought outpatient services independently (N=155). DRS and the 13 and 5-level SRS scores were collected upon admission, discharge, and at six-month follow-up. The data were analyzed using 2x3 ANCOVAs (program type) and linear regression with development of predictive equations.

Results: For DRS scores, there was a main effect of time at p≤.0005. Regardless of etiology, there was a significant improvement in total DRS scores from admission (TBI mean: 7.58 and CVA mean: 7.42) to discharge (TBI mean: 4.58 and CVA mean: 4.60) and between discharge and 6-month follow-up (TBI mean: 3.00 and CVA mean: 3.02) at a p≤.0005. There was no significant interaction or main effect of etiology. There were significant differences in time for both the SRS 13-level as well as the SRS 5-level tools, with improvement in scores shown over time regardless of etiology. For the SRS 13-level, both diagnostic groups transitioned from an average score of 9.22 at admission (full-time indirect supervision) to 3.69 (overnight supervision) at the six-month follow-up time point.

Total DRS admission score was a significant predictor of discharge DRS scores (TBI: R²=.464, p≤.0005 and CVA: R²=.629, p≤.0005) and 6-month follow-up DRS scores (TBI: R²=.259, p≤.0005 and CVA: R²=.271, p≤.0005). Overall, discharge DRS (regardless of etiology) can be predicted by the following significant equation: -.554+.687(DRS total admit score) and at 6 months (regardless of etiology) can be predicted by the following significant equation: - .174+.426(DRS total admit score).

The 13-level SRS admission score was a significant predictor of SRS-13 discharge score (TBI: R²=.235, p≤.0005 and CVA: R²=.390, p≤.0005) and 6-month follow-up SRS-13 scores (TBI: R²=.032, p=.049 and CVA: R²=.160, p≤.0005).

Conclusions: Much of the current literature related to PABIR has examined the effectiveness of these programs in participants with TBI. However, this study found that participants with CVA can have similar positive functional outcomes, and these outcomes continued to improve following discharge. In addition, an individual’s functional performance can be predicted at discharge and 6-month follow-up using admission data.

Clinical Relevance: Participants following a CVA should be considered as candidates for PABIR. Rehabilitation professionals can utilize the admission SRS and DRS to better determine rehabilitation potential and more efficiently plan for discharge.
The Aging effect on brain hemodynamic changes during different walking tasks – a functional Near-Infrared Spectrometry study

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**ABSTRACT BODY:**

**Purpose/Hypothesis:** Aging affects gait performance, such as walking with head turns, that can ultimately cause falls, however the neuroimaging evidence for gait changes with aging is minimal. The purpose of this study is to investigate the aging effect on hemodynamic changes using Functional Near-Infrared Spectroscopy during different gait tasks.

**Number of Subjects:** 12 younger adults and 12 older healthy adults with right hand dominance.

**Materials/Methods:** All participants were screened prior to data collection to exclude individuals with any vestibular, balance, or mobility impairments, evidenced by a score of less than 19 on the Dynamic Gait Index (DGI), less than 21 on the Functional Gait Assessment (FGA), less than 67% on the Activities-Specific Balance Confidence scale (ABC) scale, or more than 20 on the Dizziness Handicap Index (DHI). Functional Near-Infrared Spectroscopy (fNIRS) (NIRSport, NIRx, Germany) was used to detect hemodynamic changes (HC) on the left hemisphere over the dorsolateral prefrontal cortex (DLPFC) and vestibular cortex (VESTC). An A-B-A block design was used to elicit changes in the regions of interest. Four gait tasks were studied: 1) Preferred walking speed (PWS) with looking forward-turning head right and left-looking forward; 2) PWS with looking forward-turning head up and down-looking forward; 3) PWS-tandem walking-PWS; and 4) PWS with eyes open-eyes closed-eyes closed. Each task was performed 4 times. fNIRS data were analyzed based on a spatial-temporal version of a general linear model. Group-level analysis across the subjects was performed using a random-effects model of brain activity. The level of significance was set at p < 0.05.

**Results:** During walking with horizontal (Task 1) and vertical head turns (Task 2), younger adults had a significant decrease in activity in the DLPFC while older adults had an increase in DLPFC activity. Additionally, older adults had a reduction in activity in the VESTC. During tandem walking, both age groups had a reduction in DLPFC activity. Finally, during walking with eyes closed, younger adults had a decrease in VESTC activation, whereas older adults had no change in activity.

**Conclusions:** The most significant finding was a decrease in DLPFC activity for younger adults while older adults had an increase in DLPFC activity during walking with vestibular stimulation (i.e. head turns). These results may indicate that greater attentional resources are required for older adults when walking with head turns.

**Clinical Relevance:** If walking with head turns requires additional attentional resources in older adults, physical therapists should consider implementing dual-task interventions to facilitate better compensation during balance training. By understanding the cortical activation changes during different gait tasks that occur with aging, we can improve our gait training to more accurately target specific deficits.
Background & Purpose: Lance Adams Syndrome is identified by generalized action myoclonus appearing within a few days to weeks after cardiac arrest and coma, mostly of hypoxic origin. It is often accompanied by dysmetria, dysarthria and ataxia, with relative preservation of cognition. There are limited resources available for physical therapy (PT) treatment approaches for safe and effective mobilization and management of symptoms in acute care. The purpose of this case report is to describe a variety of successful strategies utilized to address patient limitations and promote safe mobilization beginning in the pediatric intensive care unit (PICU).

Case Description: A 19 year old male presented to acute care hospital with anoxic brain injury following cardiac arrest and resuscitation due to bilateral spontaneous pneumothoraces secondary to blebs. Patient initially intubated and sedated, with multiple chest tubes and myoclonic jerking of all extremities, and underwent tracheostomy 37 days after cardiac event. He was clinically diagnosed with post-anoxic non-epileptic myoclonus, or Lance Adams Syndrome, by neurology team.

Outcomes: Patient was transferred from outside hospital (OSH) for assessment and care, intubated and sedated, 20 days after initial event. He was assessed by PT within 24 hours of transfer from OSH. Onset of myoclonus observed by therapy during second therapy session with lifting of sedation by medical team. Patient participated in early mobilization in PICU, sitting edge of bed with maximal assist of 2 therapists, and total assist for head control while intubated during second therapy session. He presented with significant myoclonus of all extremities benefiting from proprioceptive input through trunk and lower extremities with feet on floor. PT sessions progressed to use of exercise tilt table to promote weight bearing through LEs and increased tolerance to upright. Upon discharge, patient was standing for 45 seconds with 2 person moderate assist. Patient cognitively alert and following basic commands with increased time, initially responding yes/no with head nods, progressed to use of augmentative communication devices. Collaborative efforts were made to include occupational and speech therapies to maximize patient outcomes throughout hospitalization. Patient discharged to acute rehab for duration of 62 days, at which time he was able to walk 80 feet with forearm support walker and 2 person assistance. He is currently in subacute rehab and walking 15 feet with 2 person minimal assist.

Discussion: Patient benefited from early PT evaluation, assessment and intervention during acute inpatient stay. PT in coordination with medical therapies resulted in decreased myoclonus and improved ability to participate in meaningful functional mobility with decreased assistance. PT can play an important role in ongoing evaluation/assessment and treatment of patients with this diagnosis, with improved medical care and increased survival from cardiac events.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
TITLE: The effects of a combined intervention of aerobic exercise and upper extremity repetitive task practice on quality of life and mood in individuals with chronic stroke

AUTHORS/INSTITUTIONS: A.B. Rosenfeldt, S. Davidson, N.M. Zimmerman, Cleveland Clinic, Cleveland, Ohio, UNITED STATES|S. Linder, Biomedical Engineering, Cleveland Clinic, Cleveland, Ohio, UNITED STATES|J. Alberts, Center for Neurological Restoration, Cleveland Clinic, Cleveland, Ohio, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis : Declines in quality of life and mood are prevalent in individuals with chronic stroke. While motor outcomes are primarily used to determine the efficacy of rehabilitation interventions targeted to improve motor recovery, the broader impact of such interventions on quality of life is also critical to ascertain. Improvements in both quality of life and mood have been shown following interventions aimed at improving upper extremity (UE) function. The purpose of this study was to investigate the impact of a combined intervention of aerobic exercise training and UE task practice on QOL and depression compared to a time-matched control group.

Number of Subjects : Twenty-five individuals with chronic stroke provided informed consent to participate in the study.

Materials/Methods : Participants were randomized to one of three groups: forced-rate aerobic exercise combined with UE repetitive task practice (FE+RTP, n=9), voluntary-rate aerobic exercise combined with UE RTP (VE+RTP, n=8) and a non-exercise, time-matched intervention of UE RTP (n=8). Participants in the two aerobic exercise groups exercised at 60-80% of their maximum heart rate reserve on a stationary cycle ergometer for 45 minutes followed by UE RTP. The control group either participated in two 45-min sessions of RTP or completed a 45-min session of education followed by 45-min of UE RTP. All interventions occurred 3 times per week for 8 weeks. In addition to motor outcomes, non-motor outcomes evaluating QOL and mood included the Stroke Impact Scale and Centers for Epidemiologic Studies Depression Scale (CES-D), respectively. Outcomes were obtained at baseline, end of treatment (EOT) and 4 weeks following EOT (EOT+4).

Results : All three groups demonstrated significantly improved scores on the Hand Use (p<0.001), ADL (p=0.006), and Mobility (p=0.01) domains of the Stroke Impact Scale. No significant group effect was found. On the CES-D, the FE+RTP, VE+RTP, and control groups improved by a mean of 4, 1, and 3 points, respectively, which were not found to be statistically significant.

Conclusions : The 8-week intervention resulted in improvements in self-reported QOL, regardless of group allocation. As expected, improvements were limited to the domains targeted by the intervention, with non-significant changes in physical and cognitive domains. While changes in mood were not found to be statistically significant, additional analysis may help determine responders from non-responders.

Clinical Relevance : Aerobic exercise can be combined with UE repetitive task practice to improve self-reported QOL in individuals with chronic stroke.
Background & Purpose: Early weight bearing and mobilization has been shown to have multiple benefits following spinal cord injury including reduction of bone loss, improved range of motion, increased efficiency and regularity of bowel function, strengthening of trunk musculature, improved cardiovascular and respiratory function, improved neuro-recovery, and improved quality of life. The purpose of this case report is to outline a decision making process on which weight bearing intervention strategy to choose if a clinician has many options at his/her disposal. General considerations will be discussed and expanded on in relation to three patient cases with consideration of patient goals, past medical history, activity tolerance, point in therapy process, and discharge plan.

Case Description: Three patients of different ages and injury levels each suffered a traumatic spinal cord injury and participated in inpatient rehabilitation. All individuals benefited from a weight bearing program and achieved this in different ways, or with a combination of strategies. Interventions included use of a tilt table, standing frame, robotic or manual locomotor training, use of an exoskeletal device, and overground gait training with and without bodyweight support.

Outcomes: Patient 1 presented with a C3 AIS C injury with history of right knee pain related to osteoarthritis. Robotic locomotor training using the Lokomat was chosen to promote early gait training while monitoring pain. He also benefitted from use of the Ekso exoskeleton to relearn weight shifting and upright posture with carryover to overground ambulation outside of device.

Patient 2 presented with T4 AIS A injury. He was athletic, motivated, and wanted to be challenged. He utilized the tilt table with electrical stimulation, but was limited by orthostatic hypotension. Manual locomotor training was initiated as an inpatient and continued as an outpatient. He also trialed exoskeletons as options for use in a wellness program after discharge from therapy.

Patient 3 was also motivated and wanted to be challenged; however presented with C3 AIS A injury, ventilator dependent, and had a pacemaker placed at time of injury which prevented him from utilizing electrical stimulation. He used the tilt table and eventually progressed to the standing glider with the goal of it becoming an option for home. Manual locomotor training with monitoring by a respiratory therapist allowed a safe environment for early weight bearing and neural activation, and showed significant improvement in head control, decreased spasticity and improved respiratory strength.

Discussion: These three patient examples cover a range of typical presentations in spinal cord population. Each patient participated in at least one form of weight bearing therapy, and in most cases benefited from a combination or progression of modalities to reach his/her therapy goals. Some factors in the decision on what intervention modality to choose included skin status, body habitus, orthostatic regulation, patient goals, patient history, and current phase in rehabilitation process.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: The Use Of An Online Learning Management System and Supporting Technologies To Serve As Preparation For The Neurologic Clinical Specialist Examination

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ABSTRACT BODY:

Purpose: To describe the development and implementation of an online community to support individuals sitting for the Neurologic Clinical Specialist Examination using an online learning management system and additional technologies for communicating and sharing knowledge.

Description: The use of online technology has been shown to be effective in improving learning outcomes. A neurologic specific platform involving large number of individuals has been demonstrated to be an inexpensive way of increasing participant’s knowledge. Online platforms have been found beneficial by providing a framework of study and perceiving improvement in test takers’ performance in board specialty examination and national board examination. The NCS Committee of the Academy of Neurologic Physical Therapy has been tasked to develop and implement a community support for test takers. Canvas, an online learning management system, was used to host the discussion board and deliver 8 modules identified by previous test takers as lacking resources to adequately prepare to sit for the NCS examination. Modules ran for 2 weeks each. Guidelines had been previously developed for facilitators to use. These guidelines were based on the Description of Specialty Practice in Neurologic Physical Therapy. Individuals took a pre- and post-test for each module and discussions were posted to facilitate dialogue among test takers. Study groups with 5-7 participants were created based on SIG sub-topics for individuals interested in participating in distant study sessions and content sharing. Study groups engaged in synchronous study session via video calling as well as asynchronous material sharing via email and web-based document sharing. Each group was provided with initial introductions and suggested study strategies by the study group coordinator and offered ongoing support for individuals groups.

Summary of Use: 468 individuals were invited to participate
389 participants enrolled and actively participated
154,977 total page views
21 virtual study groups
19 lecturers and discussion moderators
32.65% increase in percentage of people confident of passing the NCS examination before and after the online review course
26.4% increase in percentage of people comfortable in their preparation for the NCS examination before and after the online review course

Importance to Members: The task of the NCS Committee is to increase the number of physical therapist with board specialty certification in neurologic physical therapy. The course is free of charge and is an inexpensive way of preparing for the board specialty examination. The online review course also utilizes distance technology to connect individuals from different geographic location to provide an online support community for physical therapist preparing to sit for the NCS board specialty examination.
Purpose/Hypothesis:  Motor imagery (MI) is the mental practice of physical skills without the involvement in physical practice. Participants imagine successful completion of desired tasks to activate their neuroplasticity and foster neuromusculoskeletal re-education, improving functional mobility. Though MI is gaining recognition as an effective and valuable rehabilitative intervention for many neurologic conditions, its efficacy to help treat a chronic progressive disease like Multiple Sclerosis (MS), which is associated with symptoms like fatigue, anxiety, cognitive decline, and diminished balance and functional mobility, is unknown. Therefore, the aim of this systematic review was to investigate the effectiveness of MI in rehabilitating MS symptoms.

Number of Subjects:  N/A

Materials/Methods:  Systematic searches were conducted in the following electronic databases: PubMed, SciDirect, Google Scholar, Research Gate, Web of Science, and ProQuest. Keywords used included combinations of motor imagery, mental imagery, mental practice, guided motor imagery, guided imagery, and Multiple Sclerosis. Randomized controlled trials and case studies that used MI as a form of intervention for persons with MS and published in English were included. All age ranges and types of MS were included. Case reports, unpublished articles, and studies that do not explicitly mention MS were excluded. Methodological quality of the selected studies was assessed via Physiotherapy Evidence Database (PEDro) scale.

Results:  Eight out of the 11 studies met the criteria for this systematic review. The PEDro score was 5.4/10 indicating moderate methodologic quality. Further, the forms of MI included within the selected studies involved guided imagery, rhythmic cued imagery via music or metronome, or self-generated imagery. The chosen studies varied in their frequencies and durations of intervention sessions, with a range of 2 sessions to 5 weeks of intervention trials. MI intervention resulted in decreasing the levels of fatigue and anxiety (3 studies), improving timed gait scores (1 study), and improving autobiographical memory (3 studies). No changes were seen in the Expanded Disability Status Scale or the Multiple Sclerosis Functional Composite.

Conclusions:  The results suggest that there is limited research on establishing the effectiveness of MI as a form of intervention for persons with MS. While many studies focused on evaluating the ability of persons with MS to do MI, only one study examined and showed improvement in gait speed and walking ability. Current evidence suggests MI could be useful to improve non-motor symptoms like mood states and fatigue levels in persons with MS. However, further research is needed to confirm the benefits of MI to improve motor symptoms of MS.

Clinical Relevance:  MI has the potential to provide a cost-effective and safe option for persons with MS to help them return to desired recreational and occupational activities. Clinicians may consider using MI as an adjunct treatment, particularly to alleviate non-motor symptoms for persons with MS.
Purpose/Hypothesis: Cognitive reserve (CR) is a concept in which individuals supposedly differ in ability to cope with degenerative brain pathologies. Methods to measure CR include life experiences like level of education or occupational status, with the thought that they may help supply CR via certain skill sets attributable to the specific individual, helping them to cope better against pathology. Motor and cognitive deficits differ based on the side of the brain lesion; certain tests will be affected by a lesion in one area but not in another. CR and laterality can play a role in why a stroke of the same magnitude affects two individuals differently. Purpose: To investigate explaining and measuring CR, the effect of level of education and job experience on post-stroke cognitive performance and how different side and magnitude of brain trauma can affect cognitive performance. Hypothesis: Level of education and occupation will affect post-stroke cognitive performance based on the individual's level of CR.

Number of Subjects: Seven subjects with chronic stroke were included.

Materials/Methods: Subjects were administered a battery of the Cambridge Cognition Cantab Research Suite software two times. A “CR score” adjusted for years of education and most meaningful pre-morbid occupation was developed based on the 2012 General Social Survey (GSS). CR scores were separated into “high” and “low” and were compared to performance measures.

Results: Left sided brain trauma subjects performed worse on one measure and better than Right sided brain trauma subjects on another measure. Lower CR scores were associated with decreased performance on incongruent trials of measures of performance. Demographic information and CR post-stroke alone are not independent factors that can predict cognitive performance and level of cognitive function.

Conclusions: Side of brain lesion may influence cognitive performance on certain cognitive assessments. Ongoing analyses regarding whether circuit training with cognitive components improves cognition in this population, in addition to a possible effect of occupation and years of education on cognitive function post-stroke will be presented.

Clinical Relevance: This study can be used to explain methods for quantifying CR in the post-stroke population as it relates to physical therapy.
**TITLE:** The Effects of Motor Imagery on Movement Dysfunction in Patients with Parkinson's Disease: A Systematic Literature Review

**AUTHORS/INSTITUTIONS:** R. Escorpizo, Department of Physical Therapy, Louisiana State University Health Sciences Center, New Orleans, Louisiana, UNITED STATES| N.A. Bianchi, Dana Medical Library, University of Vermont, Burlington, Vermont, UNITED STATES| M.M. Anderson, R. de Simone, N. Etre, D. Suffredini, J. Vachon, M. Yargeau, Physical Therapy, University of Vermont, Mountain Lakes, New Jersey, UNITED STATES

**ABSTRACT BODY:**

**Purpose:** The purpose of this project is to conduct a systematic literature review to:

1) Synthesize the evidence on motor imagery and Parkinson's Disease
2) Answer the question: when compared to traditional physical therapy interventions, does the addition of motor imagery improve movement dysfunction in patients with Parkinson's Disease?

**Description:** A systematic literature search was performed with a research librarian. Two pairs of researchers screened the resulting 445 articles using established inclusion and exclusion criteria. After screening, 27 articles underwent a full text review and 7 were chosen for analysis.

**Summary of Use:** A common goal in the rehabilitation of patients with Parkinson’s Disease (PD) is creating new ways of initiating movement. Motor imagery (MI) is a process of visualizing movement prior to execution as a means to improve motor function. MI has been used in physical therapy plans of care for patients with stroke, spinal cord injury, and amputation, and may be of similar benefit to patients with PD. The 7 articles analyzed in this review support this theme.

**Importance to Members:** The results of this systematic literature review showed that: 1) MI may be effective in improving gait and functional tasks in people with PD; 2) MI may be most effective when combined with other movement strategies; 3) MI appears to be most effective when sessions occur more than once throughout an intervention plan; 4) MI may be most effective if practiced when medication is working in an optimal state. The literature supports that the addition of MI to traditional physical therapy interventions is an innovative option that clinicians can add to their plans of care and may be effective in managing movement dysfunction in patients with PD. Further research is necessary to determine specific dosage, duration, technique combination, and type of mental image needed to optimize MI and produce the best intervention outcome for PD.
Background & Purpose: Many individuals experience detrimental losses of movement, postural control and overall functional mobility following SCI due to poor recruitment of muscles, inability to access motor pools, altered neural circuits, and changes within the spinal network. The use of FES and ABT following SCI are well supported, as are the benefits of utilizing BWS systems for standing and locomotor training. Despite trunk control being an essential foundation for appropriate standing posture and alignment, most studies on FES applied at the trunk focus on improving sitting and activities of daily living. However, FES has been found to be most beneficial during functional tasks and “loaded conditions”, suggesting the importance of integrating this intervention during upright tasks. The purpose of this study is to demonstrate the benefits of performing these three modalities concurrently following ISCI.

Case Description: Four individuals with cervical level injuries and AIS C participated in this activity during acute inpatient rehabilitation. Each individual participated in two to four therapy sessions, facilitated by a physical therapist, to address the patient's specific current functional impairments and therapy goals. Neurostimulation electrode placement on trunk musculature was selected based on clinical judgement. The minimal amount of un-weighting required to optimize standing posture and to ensure loaded conditions was selected. FES parameters were selected to obtain optimal response and provide trunk stabilization. ABT were selected based on current functional level and therapy goals, starting with static activities, and progressing to dynamic activities.

Outcomes: The patient's performance was observed and documented in the patient's medical record prior, during and post-intervention including level of assistance required for static and dynamic standing, standing tolerance (including time), patient self-report, assessment of postural alignment, endurance, degree of weight bearing, and trunk activation. Individuals demonstrated improvements in trunk stability, body awareness, standing tolerance, reduced level of assistance and improved motor control and quality of movement when engaged in ABT versus without FES at the trunk. Based on qualitative report from therapists and patients, FES at the trunk was effective in improving posture, alignment, body awareness and reducing compensations while standing in BWS.

Discussion: Based on these positive results, we anticipate that this intervention may be an effective treatment and should be considered as a treatment approach when working with individuals with incomplete SCI during acute inpatient rehabilitation. Additional research is recommended to further evaluate the effectiveness of this intervention.

Purpose/Hypothesis: Gait instability is a major contributor to reduced mobility in stroke survivors [1]. To ensure gait stability, neurologically intact controls use a consistent strategy of modulating mediolateral foot placement based on their center of mass (CoM) mechanics [2]. However, this strategy is disrupted in stroke survivors with an increased fall risk, particularly for paretic leg steps [3]. The purpose of this project is to quantify the ability of a novel force-field to increase post-stroke use of the typical gait stabilization strategy. We hypothesize that mechanical assistance provided by the force-field will increase the step-by-step control of foot placement, an indicator of improved gait stability.

Number of Subjects: Eight individuals with chronic stroke participated. All subjects were able to walk independently without use of an assistive device, but had gait balance deficits (mean Functional Gait Assessment score = 16/30).

Materials/Methods: Subjects first performed a 2-minute treadmill walking trial at their self-selected speed under normal (no force-field) conditions. Subjects then performed a series of random-order trials at this speed, in which they interfaced with a force-field able to influence mediolateral foot placement without interfering with anteroposterior progression [4]. The force-field was used to push the leg toward a mechanically-appropriate location during each step, based on the stabilization strategy reported in [5]. We tested four force-field control strategies of increasing complexity, which predicted appropriate foot placement based on: 1) CoM location; 2) CoM location and average step width; 3) CoM location and CoM velocity; 4) CoM location, CoM velocity, and average step width. These trials were separated by 2-minute “wash-out” trials without force-field assistance. To quantify the effects of the force-field assistance, we calculated the partial correlation between paretic step width and CoM displacement at the start of a step \( \rho_{\text{COM}} \). This metric quantifies the step-by-step modulation of mediolateral foot placement used to ensure stability.

Results: Paretic step width modulation \( \rho_{\text{COM}} \) magnitude varied significantly \( (p=0.009; \text{ANOVA}) \) across walking conditions. All four tested force-field control strategies significantly \( (p<0.05; \text{post-hoc}) \) increased the strength of the relationship between CoM mechanics and step width compared to normal walking. These improvements did not vary significantly across the tested force-field control strategies.

Conclusions: A novel force-field is able to encourage mechanically-appropriate foot placement during post-stroke gait. Ongoing work will determine if repeated training with this device can produce sustained effects on gait strategy and improvements in gait balance.

Clinical Relevance: Post-stroke functional mobility is often limited by gait instability. Our novel device has the potential to assist physical therapists in the retraining of an effective gait stabilization strategy.
TITLE: The Effects of a Kinetic Lower Extremity Orthosis on Locomotor Function in Individuals with Hemiparesis


ABSTRACT BODY:

Purpose/Hypothesis: Gait deficits in people who have hemiparesis are well-documented and include abnormal movement patterns, decreased walking speed and decreased walking endurance. Weakness in the hip, knee, and ankle musculature contributes to these impairments. Current evidence suggests that hip flexion assist orthoses can improve locomotor function in individuals with hemiparesis. The KICKSTART™ Walking System, developed by Cadence Biomedical, was designed to assist in hip and knee flexion and assist plantar flexion. The purpose of this study was to determine if the KICKSTART™ Walking System improved locomotor function in persons with hemiparesis. We hypothesized that use of the KICKSTART™ Walking System would improve locomotor function, both immediately and with prolonged use.

Number of Subjects: Nine individuals with gait impairments secondary to hemiparesis enrolled in the study. Eight were stroke survivors, 1 had a traumatic brain injury. All but 1 of the 9 participants (7 males, 2 females) completed the study. Mean age was 54.4 (11.2) years, and time since onset was 6.4 (3.0) years. Of the 8 participants that completed the study, 4 had the left side body involvement.

Materials/Methods: The current study used a prospective quantitative, quasi-experimental, within subject comparison design. Participant’s walking activity was tracked using The Up Move™ activity tracker for all 8 weeks of the study. After a 4 week baseline period, subjects were custom fit with a KICKSTART™ Walking System and asked to wear the brace for a minimum of 1 hour to a max of 8 hours per day, 5 days a week. The spatiotemporal parameters and kinematics of gait were assessed at weeks 0, 4, and 8 using GAITRite, Vicon, and Motion Monitor systems. Locomotion at weeks 4 and 8 was evaluated with and without the KICKSTART™. Paired t test analyses were performed to compare the following: 1) Acute effect comparing week 4 brace to week 4 no brace, 2) Prolonged effect comparing week 4 no brace to week 8 with brace, and 3) Therapeutic effect comparing week 4 no brace to week 8 no brace.

Results: Acute effects of the brace included significantly decreased toe out, step length, stride length, and single limb support time. Prolonged use effects included significantly decreased velocity, increased involved limb step time, increased step time differential, and decreased toe out. No significant therapeutic effects were observed. In addition, no significant changes in kinematics were observed for any of the comparisons.

Conclusions: Application of the KICKSTART™ did not immediately improve gait spatiotemporal parameters or kinematics in individuals with hemiparesis. In addition, four weeks of a home-based self-selected walking program using the KICKSTART™ did not improve locomotor function.

Clinical Relevance: While the literature supports the use of devices that assist hip flexion to improve walking ability in individuals with hemiparesis, the current study does not support the use of this particular hip flexion, knee flexion, and plantarflexion assist device in a home based walking program.
**TITLE:** The effects of transcranial direct current stimulation on cortical excitability and motor behaviors of the lower extremity: a systematic review.

**AUTHORS/INSTITUTIONS:** J.T. Floyd, B. Sydney, B.N. Light, C. Price, C. Lairamore, Physical Therapy, University of Central Arkansas, Conway, Arkansas, UNITED STATES

**ABSTRACT BODY:**

**Purpose:** Transcranial direct current stimulation (tDCS) is a noninvasive brain stimulation technique that can increase or decrease neuronal resting membrane potentials (depending on the polarity of tDCS applied) making it either easier or more difficult for the targeted neurons to be depolarized. Numerous studies have investigated the use of tDCS to target the upper extremity motor cortex and have demonstrated anodal tDCS can increase cortical excitability and improve performance on upper limb motor task. However, the literature is limited regarding the effects of tDCS when the lower extremity (LE) motor cortex is targeted (LE tDCS). The purpose of this systematic review is to analyze the current literature regarding the effects of LE tDCS on cortical excitability and performance of LE motor tasks.

**Description:** A systematic literature search was conducted using the following databases: CINAHL Complete, Proquest Health & Medical Complete, Proquest Nursing & Allied Health Source, SPORTDiscus, and Pubmed Central. References were screened using pre-defined inclusion and exclusion criteria. Of the 1377 titles found, 30 met the inclusion criteria and were fully reviewed and critically appraised by two researchers certified in the use of the Physiotherapy Evidence Database (PEDro) scale. Additionally, the Oxford Centre for Evidence-based Medicine - Levels of Evidence 2009 scale (CEBM) was used to quantify the level of evidence for each article.

**Summary of Use:** The majority of the articles reviewed were preliminary studies with a small sample size, PEDro scores ranged from 3 to 9 with the majority of the articles scoring 6 or less, and CEBM scores ranged from 2b to 4 with the majority of the articles being ranked at 2B (low quality randomized controlled trial). Based on the literature review, there is preliminary evidence that LE tDCS may have the potential to improve performance on LE motor tasks in healthy adults and subjects with stroke or Parkinson's disease. Additionally, there is preliminary evidence that LE tDCS can significantly increase or decrease (depending on polarity) cortical excitability of the LE motor cortex in healthy adults. However, in subjects with stroke, the effects of LE tDCS on cortical excitability were mixed. The variability in responsiveness to LE tDCS in the subjects with stroke was likely dependent upon the severity of the stroke. While there is emerging evidence that LE tDCS may have the potential to increase cortical excitability of the LE motor cortex and improve lower extremity motor training the effects of LE tDCS are still in question.

**Importance to Members:** While tDCS holds promise as a potential adjuvant to prime the LE motor cortex and enhance neuroplasticity when paired with physical therapy interventions, further study is warranted prior to its use in a clinical setting.
Differential Diagnosis of Vertigo following Superior Canal Dehiscence Repair.

M.K. Root, Vestibular Physical Therapy outpatient department, NYU Langone Medical Center, Brooklyn, New York, UNITED STATES | J.L. Fay, Physical Therapy, NYU Langone Medical Center/Rusk Rehabilitation, Brooklyn, New York, UNITED STATES

Background & Purpose: Superior canal dehiscence (SCD) is an abnormal opening of the bone on the superior semicircular canal (SCC), causing symptoms including autophony and vertigo associated with pressure changes and loud noises. Surgical options include canal plugging and canal resurfacing. Physical Therapy is not often prescribed for SCD and symptoms generally resolve after surgery. Following SCD repair some patients demonstrate disequilibrium that persists, or worsens during the acute phase, but most patients regain balance after 6 weeks. Benign Paroxysmal Positional Vertigo (BPPV) may be an explanation for these postoperative symptoms, however there is limited literature describing the association between SCD repair and onset of BPPV. The purpose of this case is to illustrate differential diagnosis between postoperative complications and BPPV following SCD repair as well as to demonstrate the efficacy of vestibular rehabilitation (VR) after successful SCD plugging.

Case Description: Patient (Pt) was a 39 year old male who underwent right SCD resurfacing. Immediately following the procedure, the Pt reported severe vertigo, dizziness and imbalance which required him to stay an extra 4 days in the hospital. At his vestibular evaluation 10 days after discharge, the Pt reported severe vertigo and imbalance. He was unable to walk without a rolling walker or holding on to furniture. He presented with right posterior SCC BPPV, he was considered to be at risk for falls based on Functional Gait Assessment (FGA) and balance confidence score. Additionally he scored high on the Dizziness Handicap Inventory (DHI) indicating high perceived functional limitation due to dizziness and imbalance.

Outcomes: Pt initially presented with nystagmus consistent with right posterior SCC BPPV, however after several repositioning maneuvers his nystagmus became anomalous. He demonstrated improvements in balance with VR though continued to report episodic vertigo. After referral to his surgeon, it was determined the repair was unsuccessful. Seven months after the initial resurfacing Pt underwent right superior canal plugging and returned to VR. After 2nd surgery bilateral dix-hallpike was negative without reports of vertigo. The Pt received standard VR and demonstrated clinically significant improvements in outcome measures. Pt was discharged with minimal symptoms and was able to return to work as a dentist.

Discussion: Pts with balance deficits after SCD repair have been shown to recover within 6 weeks after surgery, however there is limited research to support efficacy of VR with persistent symptoms after surgery. This Pt did not respond to repositioning maneuvers for positional vertigo after several attempts and was referred back to his surgeon due to persistent complaints of constant dizziness. Pts with ongoing symptoms post SCD repair may benefit from VR, however careful consideration of their progress is imperative. Lack of improvement in therapy may warrant referral back to the physician for further consideration. After successful surgery Pts will benefit from standard VR.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Title: Clinically Assessed Motor Impairment Predicts Torque Matching Impairment in Chronic Stroke Population

Authors/Institutions: J.P. Dewald, PTHMS, BME and PM&R, Northwestern University, Chicago, Illinois, UNITED STATES|J. Drogos, Physical Therapy and Human Movement Science, Northwestern University, Chicago, Illinois, UNITED STATES|N. Gurari, Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES|N.A. van der Helm, BME, Delft University of Technology, Delft, NETHERLANDS

Abstract Body:

Purpose/Hypothesis: Isolating the impact of impaired motor control and perception on physical disability in individuals with stroke proves challenging. Moreover, determining how impaired motor control and perception affect one another is also difficult. In the clinical setting, we often obtain clinical measures of motor impairment; however, we do not know how these measures of motor impairment relate to an individual’s perceptual ability. Here, our goal was to determine whether a common clinical measure of motor impairment could predict a perceptual impairment in a chronic hemiparetic stroke population. Specifically, we investigated whether between arms torque matching ability, which is important for performing bimanual tasks, can be predicted based on a common clinical outcome measure assessing motor impairment.

Number of Subjects: 12 participants (mean + SD age: 60 + 9) with chronic hemiparetic stroke (>1 yr post; mean + SD yrs: 10.5 + 6.8) partook in this study. Upper Extremity Fugl-Meyer Motor Assessment (UEFMA) scores ranged from 12 to 56 (mean + SD: 32 + 13).

Materials/Methods: Participants’ maximum voluntary torque (MVT) for elbow flexion was obtained for each arm, independently. Next, participants’ between arms torque-matching ability was characterized bi-directionally. Participants’ forearms were casted and rigidly fixed to two distinct custom isometric measurement devices. Participants generated 25% of their elbow flexion MVT at their reference arm, while visual feedback indicated their self-generated reference torque. After maintaining the target torque for 3s, participants used their opposite arm to match the reference torque. This task was performed in blocks of ten trials, and the paretic and non-paretic arm were randomized as the reference.

Results: UEFMA score moderately predicted participants’ between arms torque matching error. The predictive ability was better when participants referenced their paretic arm ($R^2_{\text{Adjusted}}=0.42$, $p=0.014$) rather than their non-paretic arm ($R^2_{\text{Adjusted}}=0.32$, $p=0.032$). However, the magnitude of the slope, $|m|$, relating torque matching error to UEFMA score was nearly seven times steeper when the participant referenced their paretic arm ($|m|=8.88$) rather than their non-paretic arm ($|m|=1.32$).

Conclusions: In the chronic hemiparetic stroke population, the degree of between arms torque matching impairment increases with clinically assessed motor impairment level. However, the predictive nature is stronger, and has more functional implications, when the individual references their paretic rather than their non-paretic arm.

Clinical Relevance: These results demonstrate that a perceptual deficiency (between arms torque-matching impairment) can be predicted based on a clinical assessment of motor impairment (UEFMA) in the chronic hemiparetic stroke population, primarily when the paretic arm initiates the task. This discovery may have implications for the impact of altered limb usage on torque perceptual impairments.
Evaluation and Treatment of a Patient with Bilateral Upper Extremity Paresis and Visual Deficits: A Case Report on a Rare Clinical Presentation

K. Dewar, University of Florida, GAINESVILLE, Florida, UNITED STATES

Background & Purpose: Myocardial infarctions (MI) are often associated with neurologic deficits including anoxic brain injury. A rare complication is a central cord spinal cord injury from traumatic intubation. Physical therapy treatment is highly variable for neurologic conditions and there is currently a lack of standardized evidence-based practice for treating those with neurologic injuries resulting from MI. This case report will describe interventions used in conjunction with various applications of neuromuscular electrical stimulation to facilitate improvement in the complexity of impairments identified in a particular patient following cardiac arrest, anoxic brain injury, and suspected central cord injury. The second aim of this case report developed as clinical presentation began to shift treatment paradigm, drawing attention to the possible presence of a rare under-studied clinical presentation, Man-in-the-Barrel with Balint’s Syndrome, and to provide insight on prognosis, treatment, and outcome for this condition.

Case Description: A 59-year-old male sustaining an anoxic brain injury following MI with cerebral cortex infarctions in bilateral ACA/MCA/PCA watershed zones. The patient presented with bilateral upper extremity paresis, deficits in cognition, vision, lower extremity proprioception and coordination, gait and balance. The clinical presentation of this patient was consistent with Central Cord Syndrome, hypothesized to have occurred as a result of endotracheal intubation. Physical therapy treatments primarily consisted of balance and gait training emphasizing attention to task and environment, upper extremity functional training with neuromuscular electrical stimulation, targeting practice, and functional cognitive task training based on impairments found during the examination and continuous evaluation.

Outcomes: Results for bilateral upper extremity Active Range of Motion demonstrate an increase beyond the Minimal Detectable Change in nearly all planes, indicating a meaningful clinical difference in AROM. An overall change in Functional Independence Measure score indicates a meaningful improvement in functional gain. Results also demonstrate a meaningful clinical difference in right grip strength twice the Meaningful Clinically Important Difference value.

Discussion: It can be inferred from the results that the treatments chosen were effective in addressing many of the patient’s functional impairments over the course of his three week stay in inpatient rehab. Many of the outcomes assessed were improved by values far greater than those required to be considered clinically meaningful. Signs, symptoms and available findings are arguably consistent with the presentation of Man-in-the-Barrel Syndrome and results may have implications for further understanding of this rare condition.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
FUNCTIONAL OUTCOMES AFTER PARTICIPATION IN A WEEK-LONG, INTENSIVE EXERCISE PROGRAM OFFERED ANNUALLY TO PERSONS WITH PARKINSON DISEASE: A CASE SERIES


Abstract Body:

Background & Purpose: Parkinson Disease (PD), the second most prevalent neurodegenerative disorder, is characterized by rigidity, bradykinesia, tremors and postural instability. Functional decline is expected as the disease progresses. Intensive exercise programs have been studied in persons with PD, but not a week-long intensive model. The purpose of this case series is to describe the outcomes for participants with PD who completed at least two offerings of an annual, week-long intensive exercise program, Movement Camp (MC).

Case Description: Nine participants, Hoehn and Yahr stage 2-3, completed two or more of four annually scheduled MCs. One participant completed all four consecutive MCs. One participant completed three consecutive MCs. Two participants completed three MCs with a one-year gap between participation. Two camps were completed by five participants, three of whom participated in consecutive years. The MC week consisted of 3.5 full days of exercise, 5.5 hours per day, (19 hours of exercise in one week), and two half days of testing. In pairs or trios, participants rotated daily through four high-intensity, literature-based, one-hour intervention stations where they completed exercises targeting balance, gait quality, endurance and upper extremity function. Participants also completed three 30-minute group sessions: warm-up, cool-down and flexibility training. Testing was completed at the beginning of the week, immediately post intervention and at six-weeks post intervention. Participants (n=8) in the most recent MC have not completed the six-week post intervention testing. This testing is scheduled for July of 2017. Therefore, the last available outcome data for those participants are the immediate post intervention measures from MC 2017.

Outcomes: The time from initial baseline to last outcome measure completed ranged from one to three years. When comparing initial baseline measures (from the first camp) to the last measure for each individual, all improved in the Mini-BESTest, eight of nine in the 6-minute Walk Test, seven of nine in the five times sit to stand and fast gait speed, and six of nine in the Unified Parkinson Disease Rating Scale motor portion.

Discussion: Outcomes suggest that functional gains made after initial participation in a week-long intense exercise program may be maintained or further improved through yearly participation in a similar exercise program.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): De Lau LM, BretelerMM. Epidemiology of Parkinson’s disease. LancetNeurol 2006; 5:525-535.


AUTHORS/INSTITUTIONS: C. Black, J. Fair, K. Hopper, H. Perron, A.W. Coventry, Physical Therapy, Franklin Pierce University, Manchester, New Hampshire, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis: Parkinson’s Disease (PD) is on the rise and is now the second most common neurodegenerative disorder in the US. It presents with many motor and non-motor symptoms. This systematic review was conducted to determine what type of physical therapy intervention provided greater improvements in motor function in patients who have PD. The interventions included compared non-amplitude oriented treatment and the Lee Silverman Voice Training - BIG (LSVT-BIG) program.

Number of Subjects: Nine articles were included in this systematic review with a total of 423 subjects.

Materials/Methods: The researchers identified nine articles to utilize in this systematic review through database searches of Academic Search Premier and PubMed, and application of inclusion and exclusion criteria. The nine articles were then assessed using the PEDro scale for validity and significance. Three articles included subject participation in LSVT-BIG, and six articles included non-amplitude based exercise interventions. Primary outcome measures utilized were the Unified Parkinson’s Disease Rating Scale III (UPDRS-III), Six Minute Walk Test (6MWT), Ten Meter Walk Test (10MWT), Timed Up & Go (TUG), Parkinson’s Disease Questionnaire -39 (PDQ-39), vital signs, and gait analysis.

Results: Seven of the nine articles were judged to be of moderate to high quality, while two articles were of moderate to low quality. Three of the nine articles supported that the LSVT-BIG program improved motor function in patients with PD as compared to non-amplitude oriented and more conventional treatments.

Conclusions: The evidence in support of amplitude based interventions (LSVT-BIG program) compared to non-amplitude oriented treatment in motor function in patients with PD is encouraging, but not conclusive. Further research for this intervention is warranted to evaluate the benefits of neuroplasticity on motor and non-motor effects of PD.

Clinical Relevance: LSVT-BIG offers promise for improved movement and function for patients with Parkinson’s Disease. Other non-amplitude oriented physical therapy interventions also improve patient movement. Further research is needed.
TITLE: An individualized locomotor training for freezing of gait in Parkinson's disease augmented by transcranial direct current stimulation: a case report.

AUTHORS/INSTITUTIONS: J. Rice, Physical Therapy, University of Miami, Miami, Florida, UNITED STATES|S. Aldraiwiesh, J. Gomes-Osman, Physical Therapy, University of Miami Miller School of Medicine, Coral Gables, Florida, UNITED STATES|A. Swarowsky, Physical Therapy, University of Santa Catarina State, Florianopolis, BRAZIL

ABSTRACT BODY:

Background & Purpose: The cognitive demand during locomotion is particularly challenging for individuals with Parkinson's Disease (PD) whom experience freezing of gait (FOG), as freezing often occurs when an individual is required to divide attention between walking and a second task. While the pathophysiology of FOG is not fully understood, there is evidence to support disrupted activation patterns in the supplementary motor (SMA). In addition, non-invasive brain stimulation with transcranial direct current stimulation (tDCS) has the potential to augment the effects of locomotor training by supplementing cortical activation in areas found to be hypoactive. Our objective was to assess the feasibility and preliminary efficacy of the an individualized approach for the retraining of walking, combined with non-invasive brain stimulation to the SMA in two individuals with PD whom experienced FOG.

Case Description: Two PD-FOG participants were evaluated with Hoehn and Yahr stage II and III and baseline Unified Parkinson's Disease Rating Scale (UPDRS-III) motor sub score of 29 and 46 respectively.

Outcomes: An assessment battery was performed in the “on” phase of medication at baseline and following the 3-week protocol. Feasibility was assessed by measuring the percentage of adherence and occurrence of adverse events. Preliminary efficacy was assessed with the outcome measures: the freezing of gait questionnaire (FOG-Q) to assess freezing, Timed-up-and-go (TUG) and TUG with dual-task (TUG-DT) to assess walking function and cognitive reserve, and the Montreal Cognitive Assessment (MOCA) for a global cognition screening. The intervention was comprised of 45-minute training sessions, 3x per week for 3 weeks, where the individual performed tasks specifically designed to provoke and train freezing, increasing in complexity throughout the training and incorporating motor and cognitive dual-tasks. TDCS (2mA) was applied to the SMA concomitantly with training. Adherence to the protocol was 100% without any adverse events. The two participants demonstrated a decrease in severity and frequency of freezing episodes (Change in FOG-Q P1=-7, P2=-7), improved walking function (Change in TUG time P1=-0.45, P2=-42.4) and cognitive reserve (Change in TUG-DT time P1=-2.45, P2=-66.3). Global cognition was improved in P1 and maintained in P2 (P1-MOCA baseline 16/posttest 26; P2-baseline 27/posttest 27). The improvement of 10 points found for P1, was unexpected, but could have happened due to the low cognitive profile initially presented.

Discussion: Our results demonstrate the safety and preliminary efficacy of the this individualized intervention associated with tDCS targeted to the SMA in two individuals with FOG. Our results point to promising results of this novel approach to improve FOG and suggest further examination of this protocol in a larger sample.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
**Title:** Backward walking speed shows potential to serve as an indicator of mobility impairments in community-dwelling stroke survivors

**Authors/Institutions:** D.J. Clark, Brain Rehabilitation Research Center, Malcom Randall VA Medical Center, Gainesville, Florida, UNITED STATES| K.A. Hawkins, E.J. Fox, Physical Therapy, University of Florida, Gainesville, Florida, UNITED STATES| C. Balasubramanian, F. Alqahtani, University of North Florida, Jacksonville, Florida, UNITED STATES

**Abstract Body:**

**Purpose/Hypothesis:** Previous research has shown that, when compared to forward walking, gait characteristics during backward walking are more impaired in the elderly. Specifically, backward walking speed (BWS) was significantly slower in elderly fallers compared to the non-fallers. Backward walking ability has not been assessed in community-dwelling individuals post-stroke. It is unclear if backward walking can add any value to mobility assessment in individuals post-stroke. We hypothesized that BWS will be significantly slower in individuals who are more fearful of falling.

**Number of Subjects:** Thirty-two persons (age = 60 ± 13 years; female = 11) with a diagnosis of a single stroke (time since stroke = 28 ± 21 months) and who walked independently without physical assistance from another person participated.

**Materials/Methods:** Individuals walked forward and backward for a distance of 10 meters at their preferred walking speed. Two trials were collected for each walking condition. Walking was timed with a stopwatch and walk times were used to calculate the speed. Subjects also completed the self-report questionnaire, Activities-specific Balance Confidence (ABC) scale that has earlier been validated in the stroke population for measurement of fear of falling. Spearman’s correlation coefficient tested the relation between BWS and ABC. Post-hoc non-parametric t-tests compared sub-groups of data categorized based on BWS.

**Results:** Consistent with prior studies, BWS (0.42 ± 0.19m/s) was significantly slower than FWS (0.83 ± 0.29m/s) in our study sample (p<.001). BWS was significantly positively correlated with the ABC scores (p=0.53, p=0.002). Visual inspection of the data suggested that BWS < 0.4 m/s may be an inflection point that separates better and worse ABC scores. Post-hoc non-parametric comparisons confirmed that persons walking with BWS < 0.4 m/s (ABC scores = 59 ± 20%; n = 13) had significantly lower ABC scores (p=0.01) compared to those with BWS > 0.4 m/s (ABC scores = 78 ± 14%, n = 19).

**Conclusions:** Community-dwelling individuals with a stroke who are more fearful of falling are likely to have slow BWS. While BWS has the potential to reveal mobility impairments in community-dwelling stroke survivors, future validation studies are needed to establish BWS as an assessment for individuals post-stroke. Specifically, future studies should investigate BWS < 0.4 m/s as a cut-off score to predict fall risk in stroke survivors.

**Clinical Relevance:** Addition of BWS as an assessment has the potential to reveal mobility impairments in community-dwelling stroke survivors that may be missed in forward walking assessments.
Title: Body Weight Support Treadmill Training (BWSTT) and High-Intensity Interval Training (HIIT) Effects on Gait Performance in Chronic Cerebrovascular Accident

Authors/Institutions: B. Millspaugh Storms, AMR, Indiana State University, Terre Haute, Indiana, United States | D. Coover, Applied Medicine and Rehabilitation, Indiana State University, Terre Haute, Indiana, United States | D. M. Abshire, Indiana State University, Terre Haute, Indiana, United States | J. Shaffer, Indiana State University, Terre Haute, Indiana, United States | J. W. Vogel, Indiana State University, Terre Haute, Indiana, United States

Abstract Body:

Background & Purpose: Cerebrovascular accident (CVA) is currently the leading cause of long-term disability in the United States. Coupled with decreasing length of stays and limited reimbursement for outpatient services, there is an increasing need for evidence supporting physical therapy services for survivors of chronic CVA. The purpose of the study was to investigate HIIT as an effective intervention to improve gait in a chronic CVA survivor and to demonstrate the potential for continued improvement when HIIT is used as an outpatient-styled intervention.

Case Description: One participant, a chronic CVA survivor, was recruited from the Terre Haute, IN community. The participant exhibited multiple gait deviations, including asymmetry of weight bearing and step length, resulting in poor gait efficiency and decreased functional independence. Intervention consisted of BWSTT combined with HIIT. HIIT sessions were intermixed with continuous endurance sessions, while still utilizing BWSTT. To evoke proper gait mechanics, both verbal cues and manual facilitation were provided by the investigators. All sessions were completed in eight weeks, three sessions per week, each lasting no longer than 60 minutes.

Outcomes: Pre-test and post-test values for the Timed Up and Go (TUG), 6 Minute Walk Test (6MWT), step length, step asymmetry, average gait speed, heart rate (HR), and blood pressure (BP) were assessed in order to observe percentage of change between baseline and post intervention. The participant in our study improved her TUG test from 23.68 seconds (s) to 21.21s (10.43% change), improved distance in the 6MWT from 252 feet to 332 feet (31.75% change), right step length improved from 12.4 inches (in) to 15.5in (20.00% change), left step length improved 16.2in to 18.9in (14.28% change). Step length asymmetry improved with a reduction from of 16.20% to 10.40%. Average gait speed increased from 0.82 mph to 1.02 mph (24.39% change). Cardiovascular improvements include: heart rate improved from 70 bpm at rest to 64 bpm at rest (8.57% change), systolic BP improved from 139 to 108 (22.30% change), and diastolic BP improved from 84 to 68 (19.05% change).

Discussion: The values of TUG, 6MWT, cadence, and step length for both right and left lower extremities increased while a decrease was seen in HR, systolic BP, diastolic BP, and asymmetry values between right and left steps. Functional improvements included a more efficient, normalized gait pattern with improved cardiovascular endurance. These outcomes suggest HIIT, when combined with BWSTT, may produce positive functional changes for chronic CVA survivors. While more research is needed to draw formal conclusions, this study challenges the notion that gait improvements are difficult to attain for those who sustained a CVA >4 years ago, and provides evidence for those CVA survivors who desire continued care.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Complementary interventions; such as boxing, Tango, and Tai Chi, are often utilized as an adjunct to traditional Physical Therapy. The purpose of this systematic review is to evaluate the effectiveness of complementary therapies in improving motor deficits related to Parkinson’s disease (PD).

**Number of Subjects**: 6 randomized controlled trials (RCTs) and 1 case series (n=7)

**Materials/Methods**: Articles were retrieved from EBSCOhost, Academic Search Complete, MasterFILE Premier, and Google Scholar. The search was limited to peer-reviewed, full-text articles published in English. Keywords and phrases used in the article search were: Parkinson’s disease, alternative physical therapies, complementary physical therapies, traditional physical therapy, tango and physical therapy, tango and Parkinson’s, LSVT Big, Tai Chi, Rock Steady boxing, and boxing for Parkinson’s disease. Randomized control trials and core controlled trials were assessed for quality using PEDro. The Modified Downs and Black Scale was used to assess for quality of articles with lower levels of evidence (non-randomized trial and case controlled studies). Four of the seven studies scored 6 [9, 10] to 7 [5, 7] on according to the PEDro scale which indicates good methodological quality. Two of the seven studies scored 5 [8, 11] based on the PEDro scale indicating fair methodological quality. One case series study scored a 16 [3] based on the Modified Downs and Black indicating fair methodological quality. A meta analysis of the data was completed.

**Results**: Seven studies, 6 RCTs and 1 case series, were identified as meeting the methodological criteria. The seven sources reported on a total of 299 individuals with PD, all of which were involved in a complementary therapy. PEDro analysis identified boxing, LSVT BIG, and Argentine Tango as demonstrating potential to improve gait, balance, and disease severity scores in individuals with PD.

**Conclusions**: Tango, Boxing, Tai Chi and LSVT Big are feasible interventions to consider when treating motor deficits associated with PD.

**Clinical Relevance**: Complementary interventions such as boxing, Tango, and LSVT-BIG can be beneficial for improving gait, balance, and quality of life for some individuals with PD. While traditional therapy has proven to be of benefit to patients with Parkinson’s disease, studies have indicated following a nontraditional method can also have a positive impact on patient outcomes. Understanding benefit and feasibility when utilizing these complementary interventions with patients can lead to improved functional gains and patient quality of life.
TITLE: REAL-TIME BIOFEEDBACK TRAINING IMPROVES GAIT AND CLINICAL MEASURES FOLLOWING 8 WEEKS OF GAIT TRAINING IN POST STROKE INDIVIDUALS.

AUTHORS/INSTITUTIONS: V. Krishnan, Physical Therapy, California State University, Long Beach, Long Beach, California, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: The residual hemiparesis in post stroke individuals is a leading cause of gait dysfunction and asymmetry. Many commercial devices can evaluate the gait parameters relating to gait; however, using the auditory biofeedback device, Walk-Even (1,2,3), a person’s gait asymmetry can be both evaluated and corrected in real-time. Thus, the purpose of this study was to investigate the effects of using Walk-Even gait-training device in chronic stroke individuals and its effects on correcting asymmetrical gait patterns.

Number of Subjects: A total of 11 subjects, 6 males and 5 females, with chronic stroke participated in an 8-week intervention study. Six subjects were in the experimental group and the other five participants were in the control group.

Materials/Methods: Both groups received strength and gait training for 40 minutes, two times per week for a total of 8-weeks. For the gait training, the experimental group was given auditory biofeedback to increase their stance time on their affected side, while the control group underwent a traditional gait training with verbal or visual cues from a therapist. The subjects’ average velocity, time taken to shift from heel to toe, average heel pressure, average metatarsal pressure, and center of pressure (COP) trajectory was collected using the F-Scan device, before and after the intervention. We also gathered pre, and post-intervention data from the following clinical measures: Activities-specific Balance Confidence Scale (ABC), Timed Up and Go Test (TUG), and Fugl-Meyer Assessment-Lower Extremity (FMA-LE).

Results: Univariate ANOVA did not show any interaction or main effect between the groups (experimental and control) and time (pre- and post-intervention) in the following variables even though the results showed a positive trend in the experimental group when compared to the control group: COP trajectory, average velocity, average heel, average force, TUG and ABC. Time taken to shift from heel to toe, maximal metatarsal pressure and stride time showed a significant interaction (p<0.05) and time effect (p<0.05), while FMA-LE showed a significant time effect (p<0.05). In addition, average metatarsal showed a significant interaction (p<0.05).

Conclusions: Conclusion: The interaction effect in many parameters of gait confirmed that both groups improved after 8 weeks, but the improvement was greater in the experimental group. In particular, the experimental group placed more weight onto the forefoot during walking and the speed of transfer was much faster than the control group.

Clinical Relevance: Clinical Relevance: This study suggests that gait training with real-time feedback using Walk-Even might reduce asymmetry while walking and increase weight-bearing on the affected side in chronic stroke survivors.
Purpose/Hypothesis: Emerging evidence indicates that mild traumatic brain injury (mTBI) can cause impairments in autonomic responses to exertion, specifically heart rate variability (HRV). When the autonomic system performs optimally, it coordinates information about the body and environment to respond and adapt relatively seamlessly to meet the demands of physiological changes. Although post-mTBI autonomic dysfunction can be subtle, it may profoundly affect function through increased risk for symptom exacerbation and lower tolerance for physical activity. Evidence indicates that HRV can be improved through exercise, offering an intervention that physical therapists can utilize to facilitate recovery in this growing patient population. The purpose of this study was to investigate if autonomic dysfunction may persist in the sub-acute phase, after symptoms at rest have subsided. We hypothesized that HRV would differ for asymptomatic youth 4 to six weeks out from injury, compared to a cohort of healthy peers, and would therefore still likely to benefit from skilled exercise interventions although their symptoms at rest have subsided.

Number of Subjects: Two cohorts of fifteen youth, matched by age, sex, and activity-level, enrolled in the study (5 females, 10 males per cohort). The injured cohort consisted of participants who were four to six weeks post-mTBI and asymptomatic at rest. The healthy cohort was comprised of a group of healthy subjects with no history of mTBI.

Materials/Methods: Participants completed a stage of monitored rest followed by a staged, progressive exertional testing protocol on a stationary bicycle. Continuous electrocardiogram (ECG) data were collected throughout. Heart rate in beats per minute, HRV using low frequency to high frequency (LF/HF), and sample entropy of continuous ECG time series were calculated and compared between the cohorts using a mixed-design analysis of variance with an α set at .05.

Results: The analysis revealed a phase by cohort interaction for sample entropy. There was a main effect for time between the rest and exercise phases for beats per minute, with both groups exhibiting an increase in this measure when moving from a resting state to the exercise state. There were no significant effects noted between the cohorts for beats per minute or LF/HF.

Conclusions: Altered autonomic responses to exertion may still be present 4 to 6 weeks after post mTBI, even in asymptomatic individuals. The conventional measures of heart rate and classical measures of heart rate variability (LF/HF) may not fully capture impairments, while more advanced measures of heart rate variability (sample entropy) may be more sensitive to ongoing impairments. As exercise training is known to improve HRV, a progressive monitored exercise program may offer a non-pharmaceutical option for targeting putative causal pathways for mTBI symptoms and impairments.

Clinical Relevance: The lasting effects of mTBI-related autonomic dysfunction should be considered and addressed, particularly for athletes, due to the importance of physiological adaptability to their exertional needs.
TITLE: The effects of a wellness exercise class on perceived walking ability, fatigue, quality of life, and sustainability of exercising independently in persons Multiple Sclerosis.

AUTHORS/INSTITUTIONS: H. Karpatkin, Physical therapy, Hunter College, City University of New York, New York, New York, UNITED STATES | Z.D. Langer, Physical Therapy, NYU Langone Medical Center- Rusk Rehabilitation, New York, New York, UNITED STATES

ABSTRACT BODY:

Purpose: In persons with Multiple Sclerosis (MS) we determined the impact of a six-week physical therapist supervised wellness exercise class (WEC) on the perceived quality of life (QOL), self-reported walking ability, overall impact of disease, and sustainability of independent (IND) exercise four weeks later. We expected improvements in walking, and disease-specific QOL after intervention, and the outcomes maintained with IND exercise.

Description: Eight persons with MS participated in the WEC led by a Senior Neurological Clinical Specialist Physical Therapist. The WEC was one time per week, 60 minutes/session for six weeks with focus on aerobic and resistance training, stretching, and safe completion and progression. Participants were ambulatory, recruited from an MS Comprehensive Center, and cleared by their doctor for participation. All patients had recently been discharged from outpatient physical therapy (PT). Before and after the WEC, and at follow up 4 weeks later, participants completed disease-specific self-reported measures of physical and psychological impact of MS, including the Multiple Sclerosis Impact Scale 29 (MSIS-29), the 12 item Multiple Sclerosis Walking Scale (MSWS-12) and the Multiple Sclerosis Quality of Life-54 (MSQOL-54). None of the participants were exercising independently prior to the WEC. After six weeks we found that MSIS-29 scores improved from 69.5 to 52.9, MSWS-12 scores improved from 71.2 to 50.4, and MSQOL-54 scores improved from scores improved from 52.4 to 68.8. After four weeks, seven of the participants reported being active in an IND gym/fitness regime outside of rehabilitation.

Summary of Use: After discharge from outpatient PT, WEC focused on progressive resistance and aerobic exercises had a positive impact on the perceived QOL and ability to navigate the community in persons with MS. After the supervised WEC, nearly all participants continued IND exercise in the community.

Importance to Members: Leading a physically active lifestyle for those with MS may help to manage symptoms and prevent further disability. Continued individualized PT is not always feasible due to cost/insurance coverage, and WEC that focus on exercise and overall well-being may provide a social environment to increase confidence, enhance QOL, and lessen the perceived impact of disease for those with MS. This report illustrates that improvements can occur in self-reported outcomes after a WEC for those with MS. Providers should work with physical therapists to assure that after rehabilitation, affordable opportunities such as group WEC exist to help those with MS have the opportunity to independently engage in an exercise program. This bridge between therapy and discharge could safely enhance adherence to exercise post rehabilitation, and potentially, decrease the need for prolonged course of PT.
TITLE: The Impact of Community Based Group Exercise on Individuals with Parkinson Disease: An Observational Study


ABSTRACT BODY:

Purpose/Hypothesis: For individuals with Parkinson disease (PD), postural instability may lead to falls, decreased independence, and decreased quality of life (QOL). Evidence supports skilled, progressive, goal-directed exercises in group or individual settings to improve postural control and reduce falls, however, little evidence is available to identify the impact of participation in self-directed, community based programs on functional abilities. The purpose of this observational study was to explore the relationship between involvement in community-based exercise programs and gait, balance, and quality of life (QOL). We hypothesized that participation in these exercise programs may contribute to maintenance of function, but may not improve balance.

Number of Subjects: 6 community dwelling older adults with PD were enrolled (4 male; mean age=73 yrs; mean Hoehn&Yahr score=2.3); 5 completed the study

Materials/Methods: Participants were recruited from community based exercise classes. Functional mobility and QOL were measured using the Mini-BESTest, Functional Reach Test, 10 Meter Walk Test, Activities-Specific Balance Confidence Scale, and the Parkinson’s Disease Questionnaire-39. For 16 weeks, participants recorded their daily exercise duration, intensity and type and recorded falls or near falls. Participants were instructed not to modify their typical pattern of exercise and were not provided any education about exercise. Outcome measures were repeated 16 weeks later. Changes in scores were compared to validated minimal detectable change (MDC) and minimal clinically important difference and analyzed using a non-parametric Wilcoxon Signed Rank Test.

Results: Participants reported a mean of 4.9 hours of exercise a week, including 3 hours of group and 1.9 hours of individual exercise; 3.0 hours of low intensity and 1.9 hours of high intensity exercise. A fall was reported by 2 participants and near falls were reported by 2 participants. There were no statistically or clinically significant differences between pre- and post-test scores in gait, balance, or QOL measures.

Conclusions: After engagement in a self-directed exercise program, including individual and group exercise, these participants maintained gait, balance, and QOL over 4 months. Although participants scored above previously recommended fall risk cut off scores on the Mini-BESTest, 4 of the 5 participants experienced a fall or near fall. Study limitations included a small sample size, use of self-reported exercise data, and lack of a control group. Future studies are indicated to further investigate the effects of a longer study duration, larger sample size, and utilization of a rating of perceived exertion scale.

Clinical Relevance: The results of this observational study suggest that individuals may maintain balance and functional abilities through participation in group exercise programs which are not delivered by skilled clinicians. This reinforces the value of skilled, progressive, and challenging exercise programs to improve functional abilities and reduce fall risk for individuals with PD.
TITLE: How visual background field link to the postural control strategy in the virtual reality environment

AUTHORS/INSTITUTIONS: J. Conner, J. DeSandre, J. Dreyer, C. Eggers, H. Huskins, K. Shaw, E. Park, Department of Physical Therapy, University of North Georgia, Dahlonega, Georgia, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Based on a multi-degree-of-freedoms (DOFs) model using the uncontrolled manifold (UCM) hypothesis, visual information is strongly linked to postural control. The purpose of this study is to examine the effect of stationary visual background on the postural sway control. The hypothesis is that the visual background would couple into coordination of DOFs that does not move the body in space, not into combination of DOFs that move the body in space.

Number of Subjects: 12

Materials/Methods: Twelve healthy participants, 4 males 8 females, mean age 25 (±3.2) years old, have been volunteered to participate in this study. Subjects stand quietly with virtual reality (VR) goggles for 2 minutes. Three-room conditions are projected into the VR goggle; standing in white background room (CON), standing in vertical striped background room (VRT) and standing in horizontal striped background room (HOR). Twelve infrared cameras arranged around the subject are used to track the reflective markers on body segments. Variance across time of the angular motion was calculated into (1) variance associated with motion ($V_{ORT}$) of center of mass (COM) and center of pressure (COP) and (2) variance reflecting the use of flexible joint coordination to keep the position ($V_{UCM}$) of COM and COP.

Results: The property of COM and COP are not significantly changed with visual background conditions. With UCM analysis, $V_{ORT}$ was not significantly increased or decreased with visual background changes. $V_{UCM}$ to stabilize anterior-posterior COM position has increased when subject standing in vertical striped background, $V_{UCM}$ to stabilize medio-lateral COM position has increased when subject standing in horizontal striped background.

Conclusions: We can conclude that stationary background of visual information is linked to the variance related to the more flexible joint coordination to keep the COM in the space.

Clinical Relevance: This study also helps to understand how multi-degrees-of-freedom system can organize to achieve safe control of body position in space for upright standing posture. A better understanding of how sensory information that supports posture informs multi-joint postural control will provide a framework for better understanding postural disorders and potentially could lead to innovative evaluation and training paradigms.
TITLE: Visually induced fall prompts a greater center of pressure shift in older adults as compared to young adults during walking: Preliminary study.

AUTHORS/INSTITUTIONS: L. Ma, E.D. Thompson, Physical Therapy, Temple University, Philadelphia, Pennsylvania, UNITED STATES| H. Reimann, T. Fettrow, J. Jeka, Kinesiology, University of Delaware, Newark, Delaware, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Per the Center for Disease Control and Preventions, falls are the number one cause of non-fatal injuries in the US for adult over the age of 55, with medical cost estimated to be 6 billion a year. Falls are multifactorial, and fall prevention requires dynamic stability involving immediate response to external perturbation while correctly maintaining internal representation of body state during the loss of balance. Biped walking has been shown to be heavily dependent on vision, and perturbation of the visual system has been shown to destabilize the body during gait. Furthermore, studies on galvanic vestibular stimulation during gait in young adults have suggested that the CNS modulates two mechanisms to maintain medio-lateral balance in gait in response to illusory fall: A lateral ankle strategy that modulates activity of the stance leg ankle muscles during single stance at the time of perturbation. Followed by a foot placement strategy that shifts the location of the next footstep in the direction of the sensed fall, creating a bigger base of support. Preliminary data has been analyzed to determine whether the two strategies co-exist in older adult to effectively prevent a visually stimulated fall during gait.

Number of Subjects: Two older adults (mean age = 63) and nine young adults (mean age = 24), free from any neurological diagnoses.

Materials/Methods: Subjects walked on a self-paced treadmill, immersed in a virtual reality environment projected onto a curved dome that covered most of the visual field. After 15 minutes of walking to acclimate the environment, a virtual fall stimulus was delivered by rotating the virtual scene laterally around the central axis of the pathway at random intervals. Rotation accelerated at 60deg/s² for 600ms, then remained at the resulting orientation of 10.8deg for 2s, before resetting with uniform velocity over 1s. Stimuli were triggered on heel strike of either foot. Whole-body kinematic data, EMG and ground reaction forces were collected.

Results: Center of Pressure (COP) shift of stance foot at the time of visual perturbation induced an .21cm increase in ML COP amplitude towards the stimulated fall in older adult as compared to younger adults (p=0.0037). The immediate step/foot placement in older adults after visual perturbation was 1.19cm further in the direction of the stimulated fall as compared to young adults (p < 0.0001).

Conclusions: Due to a suspected higher visual dependence in older adults, visually induced fall causes a greater immediate COP displacement at stance foot, leading to a further center of mass (COM) shift and step response, compared to young adults. The abrupt displacement of COP suggests a visual dependent response, rather than a compensatory response to a misrepresented internal body orientation from vision.

Clinical Relevance: Identifying neural responses and kinematics of lower limbs to maintain balance during gait in older adults may help clinicians create more effective fall prevention programs for patients at high risk of falls.
TITLE: Locomotor Adaptation to a Unilateral Ankle Weight in Persons Post-Stroke: A Pilot Study

AUTHORS/INSTITUTIONS: D.N. Savin, S. McCombe Waller, J. Whitall, Physical Therapy & Rehabilitation Science, University of Maryland Baltimore, Baltimore, Maryland, UNITED STATES|G. Lopes Gama, Institute of Physical Activity and Sport Sciences, São Paulo, BRAZIL|L. Hughes, University of Maryland, College Park, College Park, Maryland, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Gait asymmetry in people with stroke may result in increased fall risk, energy demands during walking, and slower gait speed. It is resistant to change despite considerable emphasis on gait rehabilitation. Locomotor adaptation, which occurs on a trial-by-trial basis, is driven by error feedback, results in the performance of a new movement pattern, and may reduce gait asymmetry. By perturbing hemiparetic gait so the targeted asymmetry is magnified (error augmentation), the resultant aftereffects minimize the asymmetry. Most methods of inducing locomotor adaptation utilize equipment that is generally unavailable to clinicians. Our purpose was to (1) determine if a simple unilateral ankle weight could drive locomotor adaptation in persons with stroke compared to age matched controls, and (2) investigate differences in adaptation overground versus on a treadmill. We hypothesized that (1) persons with stroke would adapt similarly to controls with aftereffects of improved step length symmetry, and (2) overground compared to treadmill adaptation would produce aftereffects of greater magnitude.

Number of Subjects: Five participants with stroke and five age-matched controls.

Materials/Methods: Participants adapted gait during overground and treadmill walking in two sessions separated by at least one week. An ankle weight was placed on the leg with the shorter step length. Spatiotemporal data were collected via a GAITRite mat during the following time periods: Baseline, Early and Late Adaptation, Early and Late Deadaptation. Measures included step length and single limb support symmetry indices and gait speed.

Results: All participants had aftereffects of step length symmetry whether they adapted gait overground or on a treadmill. Participants with stroke responded similarly to controls. There were no differences in single limb support symmetry during overground adaptation for either group: only controls had an aftereffect after treadmill adaptation. Gait speed decreased for all participants during Early and Late Adaptation and Early Deadaptation compared to Baseline. Late Deadaptation was not different from Baseline.

Conclusions: Our findings indicate a unilateral ankle weight may be an effective means to induce locomotor adaptation in persons with post-stroke gait asymmetry. Step length symmetry aftereffects may have the potential to improve hemiparetic gait symmetry.

Clinical Relevance: An ankle weight may be a simple, low-cost way of driving locomotor adaptation in people with stroke and hemiparesis and has the potential to reduce hemiparetic gait asymmetry. It is clinically accessible and could be used in many gait contexts, thus increasing the applicability and flexibility of locomotor adaptation as a treatment tool. This study serves as preparation for future clinical studies investigating the ability of repeated locomotor adaptation to a unilateral ankle weight to decrease hemiparetic gait asymmetry long-term.
TITLE: Pre-season Subjective Reports, History of Concussion, and King-Devick Test as Injury Risk Factors.

AUTHORS/INSTITUTIONS: B. Harper, A. Aron, A. Atyam, L. Favale, A. Kopso, B. Leake, Physical Therapy, Radford University, Roanoke, Virginia, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Prior research identified male ice-hockey players with pre-season complaints of neck pain, dizziness, and/or headache as 2.4 to 3.65 times more likely to suffer concussion during the competitive season.1 The purpose of this study was to determine if female adolescent soccer players with pre-season complaints of neck pain, dizziness, and/or headaches were at increased risk to suffer musculoskeletal or concussive injury during 10-weeks of competitive play.

Number of Subjects: 23 female high school varsity soccer athletes, mean age of 16 years (±1.35), mean BMI of 21.28 (±1.92), and mean height of 165.8 cm (±5.64).

Materials/Methods: A prospective cohort study. Data collected included history of pre-season concussion, musculoskeletal injury, headache, neck pain, and/or dizziness. King-Devick (K-D) test was performed at baseline and 10-weeks. SPSS version 22 was used for statistical analysis.

Results: Increased K-D baseline scores were correlated to pre-season dizziness (p=0.034, t= -2.269). Increased K-D post-test scores were correlated to complaints of pre-season neck pain (p=0.047, t= 2.156). A history of concussion was correlated with increased risk of sustaining additional musculoskeletal and/or concussive injury during the season (p=0.008; r=0.6). When comparing groups, a history of concussion was associated with increased post-K-D scores (p=0.046; 47.4+/-5.2 vs 41.4+/-4.3).

Conclusions: This study did not replicate those found in adolescent male hockey players. Rather, the pre-season symptoms of dizziness and neck pain may have clinical relevance in conjunction with K-D scores as one initial indicator of multisystem disruption which may increase risk of concussion or musculoskeletal injury.

Clinical Relevance: Concussion injury involves multiple systems making it difficult to predict those at risk for experiencing another concussion and/or musculoskeletal injury.2-6 In adolescent female soccer, pre-season subjective complaints of dizziness and neck pain with a history of concussion in conjunction with increased K-D scores may indicate those at risk for additional concussive events and/or musculoskeletal injury. Further well controlled studies need to be conducted with larger sample sizes.
TITLE: The Use of Habituation Exercises in a Visually Impaired Patient Receiving Vestibular Rehabilitation: A Case Study

AUTHORS/INSTITUTIONS: L. Cialino, Rehabilitation, NYU Langone Medical Center, New York, New York, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Neuromyelitis Optica (NMO) is an autoimmune disorder in which the spinal cord and optic nerves are attacked by immune cells and antibodies. NMO is a relapsing-remitting disease and patients (pts) often experience increased disability during a relapse. Symptoms include loss or blurring of vision in one or both eyes, weakness, vertigo, numbness, paralysis, spasticity, and loss of bowel/bladder control. Pts with visual impairments may face challenges with balance since postural control is dependent on visual, vestibular, and somatosensory systems. Visual impairments can create difficulties performing traditional vestibular rehabilitation (VR) exercises due to the emphasis on gaze stabilization. Habituation through repeated motion or exposure to visual stimuli is another treatment option in VR to decrease dizziness. The purpose of this case study is to describe the use of habituation exercises in a visually impaired pt with NMO.

Case Description: Pt was a 39 year old female with a past medical history of NMO and legal blindness in both eyes; however, she could see contrasting shapes and colors. She presented to VR with a primary complaint of head motion provoked dizziness, frequent falls, and imbalance. Traditional habituation exercises targeted both functional and vocational activities and were added to her home exercise program. An adapted target using contrasting colors was created to use existing vision to promote stability during gait. The target was incorporated into her habituation exercises. She was seen once a week for 15 weeks.

Outcomes: Outcome measures included Dizziness Handicap Inventory (DHI), 5 times Sit to Stand (5TSTS), Activities Specific Balance Confidence (ABC) Scale, habitual gait speed, gait speed with head turns, number of falls since evaluation, and pt’s subjective report. Upon follow up, she denied falls and improved habitual gait speed (from 0.64 meters/second (m/s) to 0.77 m/s), 5TSTS (from 14.5 seconds to 11.5 seconds), ABC (from 49% to 63%), and gait speed with head turns (from 0.52 m/s to 0.59 m/s). Although her DHI declined from 24/100 to 34/100, she reported improved confidence with community ambulation, working as a choir teacher, and negotiating crowded environments.

Discussion: The pt benefited from habituation exercises with visible targets demonstrated by subjective improvement in function and decreased symptom provocation. She displayed objective improvements in habitual gait speed, 5TSTS, ABC, gait speed with head turns, and denied falls since evaluation. The treatment approach for visually impaired pts receiving VR can be limited due to the emphasis of visuo-vestibular training. Use of habituation with adapted targets may be an alternative treatment strategy in pts with visual impairments. This case presentation demonstrates how this treatment was successful in improving function and reducing symptoms in a pt with NMO.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
**TITLE:** High level mobility training is safe and feasible in a patient with a recently placed Left Ventricular Assist Device and a subsequent stroke in an outpatient neurological setting

**AUTHORS/INSTITUTIONS:** K. Sheeran, New York University Langone Medical Center, Rego Park, New York, UNITED STATES

**ABSTRACT BODY:**

**Background & Purpose:** Stroke is a complication of continuous left ventricular assist device (LVAD). Research is sparse regarding the neurological rehabilitation of a patient with a LVAD after sustaining a stroke. Rehabilitation after LVAD placement focuses on endurance training including cycling and walking at low intensity intervals. Return to high level mobility training (HLM) in people with neurological injury can improve quality of life, balance, cardiovascular health, assist in spasticity management and increase likelihood of return to work. The purpose of this case report is to demonstrate that HLM training is safe and feasible for a patient with a LVAD and a stroke.

**Case Description:** A 44 year old male status post LVAD placement and subsequent stroke, presented with bilateral foot drop, impaired gait and balance, and limited endurance. The patient (pt) independently ambulated indoors without an assistive device (AD), outdoors 6-8 blocks with a narrow based quad cane (NBQC) and a right posterior leaf spring (PLS) and negotiated 1 flight of stairs with a handrail (HR) and NBQC reciprocal ascending, non reciprocal descending. The pt participated in 7 months of 30 minute 1:1 physical therapy sessions and an additional 30 minute therapeutic exercise class 2 times per week for a total of 44 visits in a neurological outpatient setting. Exertion during sessions was measured by Rate of Perceived Exertion (RPE). Initial sessions focused on balance, bilateral lower extremity strengthening and gait. After the 10th session, treatment focused on high intensity training on a treadmill, high level balance and coordination training, and task specific exercises. Plyometrics were initiated after the 30th session.

**Outcomes:** On evaluation, the pt completed the Five Times Sit to Stand (FTSTS) [25.35 seconds], Timed Up and Go (TUG) without an AD [16.25 seconds], 10 meter walk test (10MWT) [.68 meters/second (m/s)] with a NBQC, [.72 m/s] without AD and the 6 Minute Walk Test (6MWT) [750 feet] with right PLS and NBQC. The Berg Balance Scale (BBS) [50/56] was completed on the 10th visit and the High Level Mobility Assessment Tool (HiMat) [12/54] was completed on the 41st visit. Upon discharge, with bilateral PLS and without an AD, the pt completed the FTSTS [11.87 seconds], TUG [7.85 seconds], 10MWT [1.5 m/s], 6MWT [1370 feet], and BBS [53/56]. The pt was able to run 10 meters with supervision, ambulate outdoors with bilateral PLS and a straight cane independently, utilize the subway for community access, and negotiate greater than 5 flights of stairs with a HR reciprocally.

**Discussion:** This case study illustrates that HLM training can be safe and feasible for a pt with a LVAD and a stroke in a neurological outpatient setting. Pts can be safely monitored utilizing the RPE scale. HLM goals can be achieved with an extensive and intensive physical therapy program. Further research is warranted to establish that HLM training is safe and feasible in this pt population.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

- Boyne P. Treatment Intensity – Getting to the Heart of Stroke rehab and Mobility – Considering Cardio. Combined Section Meeting. Feb 2015. Indianapolis, IN.


TITLE: Improved trunk control after robotic exoskeleton training in a patient with spinal cord injury: A case report.

AUTHORS/INSTITUTIONS: M. Poirier, TIRR Memorial Hermann, Houston, Texas, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Many studies have focused on the benefits of body weight supported treadmill training (BWSTT) in the spinal cord injury population. While many treatment outcomes of BWSTT strive to improve functional ambulation, there are many secondary benefits associated with gait training. One benefit of BWSTT is improved trunk control and improved sitting balance. Robotic exoskeleton training is a new intervention that has been found to have similar functional ambulation outcomes to BWSTT in this population. Little evidence supports the benefits of the use of robotic exoskeleton training on the SCI population. Improvements in cardiorespiratory function as well as increased muscle mass have been linked to training with a robotic exoskeleton in people with a SCI. Research has yet to explore the impact of robotic exoskeleton training on trunk control in individuals with SCI, but has been show to make improvements in individuals with a stroke.

Case Description: GH is a 37-year-old male who was referred to physical therapy with diagnosis of T4 incomplete SCI, sustained 10 years prior in a tractor accident. Outside of therapy, GH participates in a daily lower extremity stretching program and standing program with standing frame for 1 hour up to 5 times a week. GH was referred to physical therapy for treatment with the exoskeleton ReWalk. The treatment sessions focused on standing balance and ambulation in varied environments, averaging speeds of 0.47m/s and distances of 900 feet each session. The treatments were performed twice a week for seven weeks of 45 minutes spent standing and ambulating in the device.

Outcomes: At the conclusion of therapy, GH was able to improve his modified functional reach test (mFR) from 0 inches to 6 inches. The mFR has a minimal detectable change of 4.63cm for persons with T1-4 complete SCI. GH reported improved sitting balance during daily tasks, including driving. He indicated that he performed activities of daily living with improved ease and reduced need for upper extremity support. GH was able to ambulate greater than 400 feet without need of a rest break, with initially only being able to ambulate 10 feet.

Discussion: This case describes the secondary benefits of improved trunk control and endurance as a result of gait training with an exoskeleton unit. With use of an exoskeleton unit individuals are able to achieve a high number of repetitions of stepping during physical therapy sessions, with an average distance walked in this case of 900 feet. The majority of each one-hour session was spent in the standing position, with GH maintaining his balance at all times, prompting continued training even in rest. As compared to traditional BWSTT, which can require up to four support personnel, the use of an exoskeleton unit requires less assistance. The individual is able to ambulate with support of only one therapist and one rehabilitation technician with as little as contact guard assistance as training progresses.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Title: Physical Therapy for lateropulsion due to Wallenberg Syndrome

Authors/Institutions: I. Matejovsky, Rusk Institute of Rehabilitation Medicine, NYU Langone Medical Center, New York, New York, United States

Abstract Body:

Background & Purpose: Wallenberg Syndrome (WS) is a rare neurological condition derived from strokes of the lateral medulla. Symptoms include ipsilateral ataxia, vertigo, diplopia, dysphagia, impaired sensation and ipsilateral lateropulsion. Research suggests that various etiologies of lateropulsion may require different treatment approaches; however, studies on WS are lacking. WS results from injury to the vestibular nuclei causing a tilt of subjective visual vertical with an ipsilesional displacement and ipsilesional lean. This report reviews a case study in the inpatient rehabilitation setting and proposes physical therapy (PT) approaches specific to lateropulsion from WS.

Case Description: A 74 y.o. male was admitted to inpatient rehabilitation with WS secondary to acute septic embolic brainstem stroke. On evaluation, he required two person assist for transfers and four person assist to ambulate 10 ft due to severe right-sided lean, ataxia, diplopia and decreased safety awareness. Importantly, his diplopia and poor visual perception of vertical compromised his ability to use visual feedback necessary for more common treatments for lateropulsion. Instead, PT focused on verbal and tactile cues, and utilized the client’s intact perceived body posture in relation to gravity to achieve and sustain midline in static and dynamic activities both sitting and standing. Motor learning for coordination and sustained midline postural alignment were achieved with a targeted exercise program including balance and weight-shifting exercises on various surfaces, stepping to targets in various directions and over-ground gait training.

Outcomes: After 4 weeks of inpatient rehabilitation, the client’s Functional Independence Measure (FIM) scores improved significantly from 1 to 5 for transfer, ambulation, and wheelchair, and 0 to 5 for stairs. By discharge home, he was able to transfer without device and ambulate 200 ft with rollator and supervision including negotiating ramps and curbs outdoors. His right-sided lean was only evident when fatigued or when navigating obstacles. He could ambulate 40 ft without device with minimal assist and verbal cues, and negotiate 20 stairs with one rail and supervision. His diplopia and ability to use visual cues gradually improved.

Discussion: The central vestibular disorder in WS causes an impaired visual-vestibular perception of vertical, causing an ipsilesional lean and increasing risk of falls. A specialized therapy approach can lead to marked clinical improvement. As WS is typically a unilateral lesion with preserved function contralaterally, there may be sufficient redundancy in central vestibular pathways to allow partial recovery of balance. Further therapy goals for WS may include tapping into intact systems that perceive body posture such as the posterolateral thalamus, as progressive visual-vestibular exercises are introduced.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

Purpose/Hypothesis: People with Parkinson’s disease (PD) develop progressive postural instability (PI) that is refractory to medications. PI includes less flexible patterns of postural sway and center of pressure. Physical therapists (PT) have the ability to address PI with interventions that meet motor learning criteria to challenge postural shifts with repetitions that promote neuroplastic changes. The aim of this study was to determine whether a high intensity balance program would improve reactive postural stability in subjects with PD in function, activity, and participation.

Number of Subjects: Ten men and 11 women, mean age of 64.6 ± 6.2 years, were randomly placed in 2 groups (11-Control; 10-Experimental). All had confirmed PD, Hoehn & Yahr stages I-III, MMSE 27 or greater.

Materials/Methods: Outcome measures to examine multiple levels of the International Classification of Functioning, Disability, and Health were assessed at baseline, 4 weeks and 1 month later for all subjects: mini-BESTest; comfortable and fast spatial and temporal gait parameters (GaitRite™ System); and reactive dynamic motion analysis (DMA) score and time on task using the Proprio 5000™ (Proprio) for structure and function. Activity was assessed using Patient-specific functional scale (PSFS) and Activity-specific Balance Confidence Fear of Falling (ABC) scale; while the SF-36 examined participation.

Experimental subjects (PDe) completed two 15 minute training trials separated by a 5 min rest. Progressive perturbations were applied using a standard algorithm developed for use with a computer-controlled multi-directional platform (Proprio) to randomly alter platform movement by tilt (2°-25°), direction (random 360°), and speed (12.6°/s to 126°/s) within and across sessions that were scheduled twice weekly for 4 weeks. Control subjects (PDc) continued with routine activities.

Results: Significant improvements (p<.05) in DMA score and time on task, comfortable gait speed and stride were identified only in PDe. Although trends for improvement in outcomes in PDe more than PDc subjects were noted, these did not translate to differences between groups for fast gait, mini-BESTest, ABC, or SF-36 (SPSS v.19). Self-assessed ADL functions and walking improved 2.2 and 2.0 points on average, respectively on PSFS for PDe, meeting MDC values.

Conclusions: High level functioning subjects with PD who received an intensive progressive balance program significantly improved reactive balance stability and time on task. The Proprio 5000 is a tool permitting programming of an intensive reactive balance intervention that meets criteria for challenge and repetition. Trends in improvement in measures of activity and participation were noted for PDe. Tools with ordinal levels of measurement had little room for change in this group. Greater changes in activity and participation may have been realized with a longer intervention program.

Clinical Relevance: Results of this study encourage practitioners to adopt challenging, intensive balance interventions to improve reactive balance in PD.
TITLE: Cortical Thickness and Local Gyrification Index Differences in de novo Parkinson’s Disease with and without Mild Cognitive Impairments.

AUTHORS/INSTITUTIONS: A. Tessiatore, F.J. David, Department of Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES|A.M. Hufford, Physical Therapy, Northwestern University, Chicago, Illinois, UNITED STATES|D.M. Corcos, Physical Therapy & Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES|H. Nguyen, Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES|K. Stefely, Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, Illinois, UNITED STATES|J. Manes, Northwestern University Interdepartmental Neuroscience Program, Northwestern University, Chicago, Illinois, UNITED STATES|A. Kurani, Radiology, Northwestern University, Chicago, Illinois, UNITED STATES|K. Brink Saeed, Northwestern University Feinberg School of Medicine, Chicago, Illinois, UNITED STATES|K. Liu, Northwestern University, Chicago, Illinois, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Parkinson’s disease (PD) is largely considered a movement disorder, but there is increased interest in the impact cognitive deficits have on the progression and burden of the disease. This study used Magnetic Resonance Imaging (MRI) to identify structural changes in the brain which can distinguish subjects with PD who are cognitively normal (PN-CN) from PD with mild cognitive impairments (PD-MCI) while explicitly testing for sex differences. It is hypothesized that both cortical thickness (CT) and local gyrification index (LGI) will be reduced in PD-MCI compared to PD-CN across both sexes.

Number of Subjects: 75 PD-CN (47m, 28f) and 34 PD-MCI (24m, 10f). Subjects were drug naïve and within 6 months of initial diagnosis of PD.

Materials/Methods: Subjects MRI scans were collected and analyzed from the Parkinson’s Progressive Marker Initiative database and assessed for categorization into PD-CN and PD-MCI. The PD-CN group scored >26 on MOCA, and no cognitive tests >2 standard deviations (SD) from the mean, based on healthy controls. PD-MCI scored >2 SD from the mean on 2 or more cognitive tests. MRI scans were preprocessed using Freesurfer v6.0 in order to quantify CT and LGI. A between group ANCOVA using permutation based methods was performed in FSL/PALM with age, years of education, and MDS UPDRS-III as covariates. Results were reported with an alpha <0.05.

Results: Significant group differences were found in the following areas: CT: In females, CT is reduced in PD-CN compared to PD-MCI primarily in left precentral gyrus, inferior frontal gyrus, and middle frontal gyrus. There were no differences for males. LGI: In males, LGI is greater in PD-CN compared to PD-MCI primarily in bilateral superior/middle/inferior frontal gyrus, anterior temporal gyrus, precentral gyrus, and occipital cortex; right superior frontal gyrus, dorsolateral prefrontal cortex, parietal cortex, and postcentral gyrus. There were no significant results in females. Cognitive Tests: Using an ANCOVA model in SPSS we found that amongst all of the tests, Semantic Fluency was the most correlated to CT findings.

Conclusions: Our research shows novel findings of reduced CT in de novo PD-CN when compared to de novo PD-MCI in females. Furthermore, this is the first study using LGI to identifying differences between PD-CN and PD-MCI. This may be a more robust means of identify PD-MCI at initial diagnosis in males. By extending our research to the longitudinal scans of the same subjects we can then identify stable biomarkers that can track disease progression between these groups.

Clinical Relevance: By identifying biomarkers which can isolate PD-MCI at initial diagnosis, we can introduce and evaluate different treatment interventions shown to improve cognition at an earlier stage in the disease progression. One such example is progressive resistance exercise, which has been show to improve PD motor deficits and is hypothesized to improve cognitive function.
ABSTRACT BODY:

Purpose/Hypothesis: Ten percent of the United States population is affected by diabetes, a condition that leads to several complications including cognitive dysfunction. Delayed neural signals and structural brain changes were associated with cognitive dysfunction in patients with diabetes. Thus, the American Diabetes Association (ADA) recently added cognitive evaluations to the standard of care for diabetic patients. The Mini-mental Examination State (MMSE) and the Montreal Cognitive Assessment (MoCA) are the most common neuropsychological tests for the assessment of cognitive function. However, it is not known how often these tests have been performed in patients with diabetes during their visits in the University of Kansas Hospital network. Therefore, the purpose of this research was to investigate how many patients with diabetes seen by a healthcare professional at the University of Kansas Hospital network have been assessed for cognitive function. We hypothesize that only a minor portion of patients with diabetes have been assessed for cognition deficits.

Number of Subjects: 82,733

Materials/Methods: De-identified medical data was collected using the Healthcare Enterprise Repository for Ontological Narration (HERON). From a query performed on HERON on November 2016, data was extracted from the University of Kansas Hospital inpatient and from outpatient clinics affiliated with KUMC. Data was obtained on individuals with International Classification of Diseases 9 and 10 diagnosis of “Diabetes mellitus” (ICD 9 250 or ICD 10 E08-E13), and who had performed MMSE or MoCA tests.

Results: From a total of 82,733 patients diagnosed with diabetes, 271 (0.33%) had performed the MMSE more than once, whereas 71 (0.08%) performed the MoCA more than once – that is, 342 patients total (0.41%). From out of this pool of 271 patients with diabetes who performed the MMSE, 124 (45.76%) of them were also diagnosed with Alzheimer’s disease, and 94 (34.69%) with Mild Cognitive Disease. From out of the 71 who performed the MoCA, 18 (25.35%) were also diagnosed with Parkinson’s disease.

Conclusions: Only 0.41% of patients with diabetes in HERON database were screened for cognitive dysfunction by MMSE or MoCA. The majority of these patients also were diagnosed with a second chronic condition, such as Alzheimer disease, Mild Cognitive Impairment, and Parkinson disease. This study highlights that cognitive assessment in patients with diabetes, recommended by the ADA, has been underperformed. Future studies may extend this investigation to more comprehensive healthcare database, and expanded to other locations in the United States.

Clinical Relevance: Health care professionals who work with patients with diabetes should give closer attention to cognitive screenings. Regardless of presence of neurologic conditions, any patient with diabetes should be screened for cognitive decline. Following the ADA recommendations for cognitive screening may lead to early diagnosis of cognitive decline, when earlier interventions can be implemented before the aggravation of cognitive dysfunction.

AUTHORS/INSTITUTIONS: A.M. Carey, Physical Therapy - Outpatient, Good Shepherd Penn Partners / Penn Therapy & Fitness, Philadelphia, Pennsylvania, UNITED STATES.

ABSTRACT BODY:

Background & Purpose: Hemiballismus is a rare, hyperkinetic movement disorder characterized by sudden, large amplitude movements of primarily proximal musculature in a limb or limbs on one side of the body. Prognosis is dependent on etiology, but is primarily favorable with a number of medical and surgical treatment options used to control or improve motor symptoms, improve patient safety, and improve quality of life. Due to the rarity of this disorder, literature on the effects of physical therapy (PT) treatment is scarce and comprised mainly of case reports in the acute hospital and acute rehabilitation settings. To this author’s knowledge, this is the first case report detailing PT intervention for a person with hemiballismus in the outpatient setting.

Case Description: Patient is a 60-year-old female with diagnosis of hemiballismus referred to outpatient PT by neurologist/movement disorder specialist. Patient's case was complicated by multiple comorbidities including right foot complete transmetatarsal amputation 9 months prior to PT evaluation, type 2 diabetes mellitus, and hypertension.

Outcomes: Primary functional outcomes included Timed Up & Go (TUG), Five Times Sit to Stand Test (FTSST), and Six-Minute Walk Test (6MWT) and were assessed at initial evaluation, visit 10 and visit 14. Intervention consisted of functional training, gait training, neuromuscular reeducation, environmental obstacle negotiation, assistive device assessment and training, and activity tolerance to fulfill patient goals of mall shopping and casino trips. Frequency of care was 2 times per week, and the patient attended 14 sessions over the 92-day course of care. Patient demonstrated marked gains in ability to rise from chair without use of arms and was able to perform the standardized version of FTSST at visit 10. The patient demonstrated improvements in the TUG, completing in 14.15 seconds with a 2-wheeled rolling walker (2WRW) and 14.5 seconds using a single point cane (SPC), which indicated patient was at low risk for falls as compared to norms for community-dwelling adults. 6MWT distance improved from 450' at initial examination using SPC to 648' at visit 14 using 4-wheeled rolling walker (4WRW). By visit 11, patient reported the ability to shop at the mall with her daughter, fulfilling a patient-reported functional goal. The patient’s overall ambulation tolerance increased from 75' using SPC at visit 2 to 800' using 4WRW at visit 12. At visit 14, patient reported ability to walk 2 city blocks using 4WRW.

Discussion: This case study demonstrates a successful PT intervention in a patient with hemiballismus in the outpatient setting.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
Facilitating Walking Recovery with Use of a Wearable Robotic Exoskeleton in an Individual with Traumatic Brain Injury and Ataxia: A Case Study

E. Anderl, H. Trammell, Physical Therapy, TIRR Memorial Hermann, Houston, Texas, UNITED STATES

Background & Purpose: Robotic-assisted gait training (RAGT) has been shown to improve overground ambulation among individuals with various neurologic disorders including stroke, spinal cord injury, and multiple sclerosis. However, there is limited research to date on the use of RAGT with individuals with ataxia. Individuals with ataxia often demonstrate unstable gait with high variability. Wearable robotic exoskeletons can be programmed to control limb dynamics and joint coordination patterns. The purpose of this case study was to investigate the effects of RAGT on gait performance and quality for an adolescent with ataxia post traumatic brain injury (TBI).

Case Description: The patient was a 16-year-old male who presented to inpatient rehabilitation (IRF) following a severe TBI (initial GCS 3) with resulting ataxia. Upon initiation of RAGT, the patient was ambulating with a rolling walker with significant gait deviations and frequent loss of balance (LOB) requiring assistance to correct. He participated in RAGT daily across four consecutive days. In addition to RAGT, interventions included static and dynamic balance tasks and gait training with rhythmic auditory stimulation.

Outcomes: Gait speed was measured with the 10 Meter Walk Test (10MWT) and 6 Minute Walk Test (6MWT), and spatial and temporal characteristics of gait were collected utilizing the GAITRite. On an impairment level, ataxia was measured with the Scale for Assessment and Rating of Ataxia (SARA). Outcome measures were collected at baseline, immediately following the first session of RAGT, at conclusion of the intervention, and at discharge from IRF (7 days post-intervention). Following one session of RAGT, the patient demonstrated a reduction in walking distance on 6MWT from 674 feet (1 LOB) to 552 feet (no LOB) and a reduction in 10MWT speed from 0.9m/s to 0.75m/s. At the conclusion of RAGT, the patient ambulated 600 feet during 6MWT and demonstrated further reduction in 10MWT speed to 0.62m/s. At discharge from IRF, the patient retained a clinically important difference in gait speed, ambulating 0.18m/s slower than baseline. Additionally, the patient’s temporal and spatial symmetry improved with participation in RAGT.

Discussion: This case provides initial support for the use of RAGT in individuals with ataxia post TBI to promote normal gait. It is possible that the improved gait symmetry and decreased variability achieved with RAGT resulted in improved control and decreased gait speed in this patient with ataxia. Additionally, it is noteworthy that these neuroplastic changes occurred without changes in the patient’s ataxia at the impairment level, as at baseline and discharge from IRF, the patient’s SARA score was 23/40. Future research on the use of this technology for walking recovery after TBI and to identify best candidates for RAGT is merited.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


TITLE: Standardizing Stroke Outcome Measures Across the Continuum of Care: Does a Knowledge Translation Process Work?

AUTHORS/INSTITUTIONS: S.D. Lawrence, Rehabilitation Therapies, University of Vermont Medical Center, Essex, Vermont, UNITED STATES

ABSTRACT BODY:

Purpose: The purpose of this special interest report was to assess clinicians’ use of recommended outcome measures (ROM) when treating patients with stroke 16 months after implementing a knowledge translation (KT) process.

Description: A team of physical therapists (PTs) from a network of hospitals used the knowledge to action framework (KTAF) to implement a clinical practice change: the use of ROM for patients with stroke. The team identified a “know to do” gap through clinician surveys and chart audits. PTs perception of outcome measures (OM) use did not match actual use based on chart audits. Barriers to OM use were categorized as: knowledge, time, access to OM, interpretation, and documentation of results. After reviewing national recommendations, the team used a consensus model and a decision rubric to identify 12 ROM that span the ICF. The team and clinicians partnered to develop and implement a KT plan to promote ROM use. The plan included training on OM use, test interpretation and psychometric reference phrases that clinicians could easily use for clinical documentation. Chi square analyses were used to compare the frequency of clinician use of ROM with individual patients with stroke prior to implementing the KT plan and at 6 months and 16 months after implementation. 144 chart audits were performed prior to training, of these 52.1% had at least 1 ROM and 31.1% had at least 1 ROM twice with the same patient during the episode of care. 148 patient charts were audited 6 months after training, of these 87.8% had at least 1 ROM and 54.7% had at least 1 ROM twice with the same patient during the episode of care. 216 patient charts were audited 16 months after training, of these 88.4% had at least 1 recommended ROM and 59.7% had at least 1 ROM twice with the same patient during the episode of care. Chi square test of independence found a significant interaction for both use of at least 1 ROM (p<0.001) and use of at least 1 ROM twice with the same patient during an episode of care (p<0.001). Standardized residuals indicated clinicians increased their use of at least 1 ROM and use of at least 1 ROM repeated twice with an individual patient during a single episode of care after training and sustained their use of ROM 16 months after training.

Summary of Use: The KTAF provided an effective framework for knowledge broker–clinician partnership. The clinician identified barriers provided targets for innovative processes and education models as a part of the KT plan. Clinicians set benchmark targets for performance change. All sites embedded the final ROMs into electronic and paper documentation. Ongoing peer mentoring was critical to KT implementation. Clinician use of ROM was sustained 16 months after the project was completed.

Importance to Members: Clinicians across 4 organizations successfully collaborated on a KT project to increase use of ROMs in patients with stroke through the use knowledge to action framework. This process is a feasible and effective model for clinical use across hospitals and settings.
Effect of velocity training on gait endurance in persons with MS: partial results of an ongoing study

H. Karpatkin, A. Benson, N. Gardner, N. Ramos, A. Xu, N. Broker, Physical therapy, Hunter College, City University of New York, New York, New York, UNITED STATES

 PURPOSE/HYPOTHESIS: Diminished gait endurance is a common finding in persons with Multiple Sclerosis (pwMS). Previous research in both non-disabled and disabled populations has shown that interventions to increase gait speed can improve gait endurance by improving efficiency. However, the effects of interventions to increase gait speed in pwMS are not known. The purpose of this pilot study was to examine the effects of a velocity-training (VT) program on gait and balance performance in pwMS. It is hypothesized that 1) the VT program will be well tolerated by participants, and 2) persons who undergo the training program will demonstrate improvements in gait speed, gait endurance, and balance.

NUMBER OF SUBJECTS: To date, 4 pwMS (3 females, 1 male, age 50.2 +/- 8.30, EDSS 3.63 +/- 1.3) have completed the study, with one subject dropping out due to unrelated causes.

MATERIALS/METHODS: This is a pretest-posttest pilot study. Subjects are being recruited from local area MS practices and from the National Multiple Sclerosis Society. Following collection of demographics (age, gender, EDSS, use of assistive device), subject characteristics including the Multiple Sclerosis Impact Scale-29 (MSIS-29), and the Fatigue Severity Scale are collected. Subjects are then tested using the 6-Minute Walk Test (6MWT), the 25-Foot Walk Test (25FWT), and the MiniBESTest (MBT). Subjects then undergo a 6-week training period where they perform an increasing number of guarded, 20-second walks (as little as 6 to as many as 30) at their fastest possible speed, 2x/week, with each individual walk followed by a complete, 1-5-minute seated recovery period. Following completion of the training program, the 6MWT, 25FWT, and MBT as well as self-report measures, are repeated.

RESULTS: Mean 6MWT distances have improved from 1016.7 (+/- 681.2) feet to 1345.0 (+/- 793.3) feet, 25’ walk test times improved from 9.6 (+/- 5.6) to 6.3 (+/- 3.1) seconds, and MBT scores have improved from 13 (+/- 8.3) to 14.5 (+/- 7.2). No significant pretest to posttest changes in FSS or MSIS have occurred, suggesting that the intervention was well tolerated.

CONCLUSIONS: Although our current sample is small, our results suggest that velocity training is a safe, feasible, and effective intervention to improve gait and balance performance in the MS population. These findings are similar to what has been found in other disabled and non-disabled populations who have utilized VT.

CLINICAL RELEVANCE: The possibility that meaningful improvements in gait performance can be achieved in a relatively small amount of training time may have implications for PT practice, as these improvements in gait occurred following relatively short periods of exertion which did not seem to lead to an increase in fatigue. Additionally, pwMS might benefit from the specific practice of fast walking for times when this skill is necessary for safety, (e.g. crossing streets). Clinicians who work with pwMS should consider VT for their ambulatory patient to not only improve their walking speed but also walking endurance. Data collection will be continued through the end of 2017.
TITLE: Clinical characteristics of responders versus non responders to a gaming intervention in individuals with Parkinson’s disease (PD).

AUTHORS/INSTITUTIONS: S. Pradhan, Rehabilitation Medicine, University of Washington, Seattle, Washington, UNITED STATES|L. Wessbecher, Rehabilitation Medicine, University of Washington, Seattle, Washington, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: There is emerging evidence for the use of commercially available games for improvements in balance for individuals with PD. Despite that, we do not have a good understanding of what clinical characteristics of individuals with PD make them good candidates to respond to gaming favorably for improvements in balance. The goal of our study is to examine differences on baseline characteristics between responders (R) and non-responders (NR) to a gaming intervention for improvements in balance based on the Functional Reach Test (FRT). The FRT is a highly recommended measure of standing stability in individuals with PD based on the PD – EDGE guidelines put forth by the Neurology Section of the American Physical therapy Association. We hypothesized that individuals with PD who respond to gaming by showing improvements in balance will have better gait speed, walking endurance, visuo-motor speed, lesser disease severity and better quality of life at baseline.

Number of Subjects: 14 participants with mild to moderate PD.

Materials/Methods: Participants used the X box and Kinect, 3x/week for 6 weeks for 1 hour, in-person gaming session with a therapist. Commercially available games that were pre-screened to identify ones that targeted balance were used. Participants were tested before and after 18 gaming sessions on measures of self-selected and fastest possible gait speed (10 meter walk test - GS), endurance (6 min. walk test – 6MWT), balance (FRT), visuo-motor speed (Trail making task - TMT), disease severity (Movement disorders society -Unified Parkinson disease Rating Scale-MDS-UPDRS) and quality of life (Parkinson disease questionnaire-39 – PDQ-39). Responders were identified a participants who showed a difference of 7.32 cm between the pre and post intervention assessments on the FRT.

Results: There was no difference in the gait speed between responders and non-responders. Responders covered lesser distance on the 6MWT (R=1377.9(249.7), NR=1804.7 (333.1)), greater mds-UPDRS score (R=14.57 (10.3), NR= 11.85 (11.56)), higher TMT time(R=94.44(61.0), NR = 65.80(51.7)), and higher PDQ-39 scores (R=30.85(33.7), NR = (15.28(4.9)).

Conclusions: Contrary to our hypothesis, responders to gaming had lower walking endurance, visuo-motor speed, greater disease severity and worse quality of life compared to the non-responders.

Clinical Relevance: Gaming may be an option that is better suited as an intervention to improve balance in individuals with PD who are lower functioning. The higher functioning individuals may not show an improvement in balance measured by the FRT and gait speed may not give us an indication about whether a person will or will not respond to gaming.
**TITLE:** The Figure-of-8 Walk Test: early indicator of deficits in motor skill of walking for older adults with Parkinson’s disease

**AUTHORS/INSTITUTIONS:** T. Woods, K.A. Lowry, Physical Therapy, Des Moines University, Waukee, Iowa, UNITED STATES| J. VanSwearingen, Department of Physical Therapy, University of Pittsburgh, Pittsburgh, Pennsylvania, UNITED STATES

**ABSTRACT BODY:**

**Purpose/Hypothesis:** Early rehabilitation may slow disease progression in persons with Parkinson’s disease (PWP). In early disease gait speed may be normal, while deficits in the motor control of walking escape typical spatiotemporal gait measures. We examined the usefulness of the Figure-of-8 Walk Test (F8W), a measure of motor skill of walking, to recognize clinically important deficits in the motor control of walking among PWPs. We determined the validity of the F8W by relation with measures of mobility and function in persons with PWP, and sensitivity of the F8W to discriminate differences in the motor control of walking between PWP and healthy older adults (OA).

**Number of Subjects:** 77

**Materials/Methods:** Older adults with Parkinson’s disease (n=45; mean age 67.8±7.5) and without (n=32; mean age 71.7±8.7) participated. Participants performed the F8W, a figure of 8 walk pattern about two cones, 5 feet apart; time and number of steps to complete recorded. Walking ability (mean gait speed, standard deviation of stride time) was derived from usual (4 passes) and backward (1 pass) over an instrumented walkway. The Late-Life Function and Disability Instrument (LLFDI) overall, basic (BLE) and advanced (ALE) lower extremity function subscales were used to define physical function, and the Montreal Cognitive Assessment (MoCA) to describe cognitive function. Analyses included Mann-Whitney U tests for between group differences in F8W, Spearman correlations for bivariate relations with F8W, and Receiver Operating Characteristic (ROC) curves (AUC, sensitivity, specificity) for discriminate ability of F8W and gait speed for motor control of walking.

**Results:** PWP had poorer F8W compared to OA (group mean time: PWP=11.7s, OA=8.3s; steps: PWP=18.8, OA=14.3, p<.01). Within PWP group, F8W related to usual gait speed (F8time, r=-.71, p<.01; F8steps, r=-.68, p<.01), LLFDI overall function (F8time, r=-.51, p=0.04; F8steps, r=-.61, p=0.01), BLE function (F8time, r=-.42, p=0.09; F8steps, r=.54, p=0.03), and ALE function (F8time, r=-.51, p=0.04; F8steps, r=-.57, p=0.02); cognitive function (F8time, r=-.26, p=0.09; F8steps, r=-.27, p=0.08). The AUC for F8W was 84% (CI 75.1%-92.9%), and for usual gait speed 72.6% (CI 61.3%-84%). At the optimal cut-off for the F8W of 8.61s, sensitivity=84.4%, specificity=75%; for gait speed, 112.55cm/s, sensitivity=73.3%, specificity=62.5%. For OA, 20 participants had a gait speed >112.55cm/s, and of those, none had a F8W time ≥8.61s. For PWP, 12 participants had a gait speed >112.55cm/s, and of those, 8 PWP had a F8W time ≥8.61s.

**Conclusions:** The F8W demonstrated validity for use with PWP by associations with walking ability and physical function. The F8W demonstrated greater accuracy compared to usual gait speed in identifying the motor control loss in PWP.

**Clinical Relevance:** The F8W may be particularly useful as: 1) a screen early in the disease course to recognize walking difficulties not identified by gait speed, and 2) an assessment of pre/post intervention change in walking skill in clinical trials aimed at improving mobility in PWP.
TITLE: The Development of a Novel Harnessing System to Assist an Adolescent with Complete Paraplegia to Dance with Her Date at Prom

AUTHORS/INSTITUTIONS: K.M. Radfar, TIRR Memorial Hermann, Houston, Texas, UNITED STATES|A. DeVocht-Patel, The University of Miami, Miami, Florida, UNITED STATES

ABSTRACT BODY:

Purpose: The purpose of this special interest report is to describe the development, utilization and outcomes of a novel and innovative body weight supported harnessing system that was used to assist an adolescent with complete paraplegia to meet her goal of dancing at prom.

Description: A 17 year old female with a T6 spinal cord injury (SCI) AIS A presented to inpatient rehabilitation with the primary goal of standing and dancing at her senior prom scheduled 3 months post injury. With >17,000 new cases of individuals with SCI occurring annually in the USA and >30% of these as adolescents, goals of inpatient rehabilitation must focus on attainment of function while also optimizing quality of life. Adolescents with SCI face unique challenges during their recovery process secondary to being in a major developmental life period. Researchers have identified that establishing strong self-esteem, peer relationships and positive social interactions are essential for a healthy developmental progression for adolescents with disabilities and may promote a better quality of life and state of well-being. Therefore, our objective was to design an external harnessing device to allow for standing with the assistance of her date while also being discrete and allowing for normalcy among her peers.

Summary of Use: The harnessing system was fabricated using cost efficient canvas strapping with plastic buckles and consisted of 2 parts to be worn by the patient (mimicking the pattern of a rock climbing harness) and her date (mimicking the pattern of a body weight supported treadmill harness). After fabrication of the harness, the patient completed prom dress trials with the harness donned and components of the dress and harnessing system were altered to meet her needs. Additionally, the patient donned bilateral lower extremity knee extension braces under her gown. With harnesses donned, the patient was assisted into standing by her date and the harnesses were connected by an external strap, assisting the patient into hip extension. Therapeutic interventions included static standing and upright core strengthening to increase tolerance to upright positioning, tolerating >45 minutes at a time. Training with the harnessing system occurred first with the therapist, progressing to training with the patient, her date, and a friend, including education on donning/doffing and use during standing.

Importance to Members: By utilizing this uniquely designed harnessing system, this adolescent patient was able to obtain a safe and comfortable means of supporting her body weight to dance at prom, meeting a goal, improving her quality of life, and increasing her socialization among peers during a benchmark event in her life. When discussing how important it was to her to meet this goal, the patient stated, “When I got back home, I was able to do all the things that I was hoping to do... I was able to attend and dance with my boyfriend at my senior prom. To make things even more special, we were voted Prom King and Queen by our classmates.”
TITLE: Investigating Varied Levels of Visual Attention on Motor Cortex Excitability

AUTHORS/INSTITUTIONS: B. Schopke, E. Rand, R.S. Ashmun, J. Wagner, S.L. Wolf, M.R. Borich, Department of Rehabilitation Medicine, Division of Physical Therapy, Emory University School of Medicine, Atlanta, Georgia, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Transcranial magnetic stimulation (TMS) can non-invasively assess cortical excitability of the human brain. Cortical excitability is influenced by internal and external factors including inputs from attentional systems in the brain. Few studies have analyzed or controlled for specific factors that may influence primary motor cortex (M1) excitability. Altered attention is common to many neurologic conditions and can affect motor behavior. Thus, we investigated the effects of modulating visual attention on M1 excitability magnitude and variability. We hypothesized that higher attentional demands would increase cortical excitability and reduce variability.

Number of Subjects: 15 healthy, right-handed individuals aged 18-35 years.

Materials/Methods: Participants completed a single TMS assessment during three different visual attention conditions. During condition 1, participants were instructed to look at a blank computer screen. A modified version of the Eriksen Flanker task was used for conditions 2 and 3 where three arrows facing the same direction (congruent) were presented simultaneously with TMS delivery. In condition 3, the center arrow infrequently appeared (~10% of trials) in the opposite direction (incongruent) and participants counted the number of incongruent trials. Motor evoked potentials (MEPs) from the first dorsal interosseous (FDI) muscle were elicited by TMS delivery over the contralateral M1. TMS measures of corticospinal and intracortical excitability were collected. Three test blocks consisting of each condition were completed. TMS measures were randomized within blocks and attention conditions were randomized between blocks. Mean and standard deviation of MEP amplitudes were the primary dependent variables. Repeated-measures ANOVAs were conducted to evaluate effects of condition, block, and TMS measure on the primary dependent variables.

Results: No significant difference in MEP amplitude or standard deviation was observed across visual attention conditions or test blocks. MEPs demonstrated high inter-individual variability across conditions. MEPs were more variable in inhibitory intracortical circuits compared to facilitatory circuits (p<.05) but were not significantly different between visual attention conditions or across test blocks.

Conclusions: Results suggest that manipulating levels of attention in young, neurologically-intact individuals does not significantly modulate M1 cortical excitability. No changes in cortical excitability were observed over the testing session suggesting randomization of attention conditions mitigated potential effects of fatigue and reduced arousal levels.

Clinical Relevance: The current findings can be used to inform future studies investigating motor cortex excitability in neurological populations or appropriate age-matched individuals. Reduced levels of attention in neurologic patients may potentially impact therapeutic response by affecting M1 excitability. Thus, characterizing the influence of attention on the motor system has important implications for the provision of neurological physical therapy.
**TITLE:** Subclinical Vestibular Dysfunction in People with Unilateral Lower Limb Amputation  
**AUTHORS/INSTITUTIONS:** M.C. Schubert, Johns Hopkins, Baltimore, Maryland, UNITED STATES|C. Bennett, Music Engineering, University of Miami, Coral Gables, Florida, UNITED STATES|J.G. Moore, V. Agrawal, K.J. Kim, Physical Therapy, University of Miami, Coral Gables, Florida, UNITED STATES|J.L. Lucarevic, R. Gailey, S.M. Clemens, physical therapy, university of miami, Coral Gables, Florida, UNITED STATES|A. Symasack, Walter Reed National Military Medical Center, Bethesda, Maryland, UNITED STATES|I. Gaunaurd, Research, Miami Veterans Affairs, Miami, Florida, UNITED STATES|  
**ABSTRACT BODY:**  
**Purpose/Hypothesis:** People with unilateral lower limb amputation (LLA) have a significant loss of afferent somatosensory information due to loss of their limb; therefore utilizing the information from the vestibular system may be more critical to maintaining balance and preventing falls. Recent literature has shown that vestibular neuropathy is a complication of Diabetes Mellitus (DM), but it has not been examined in people with LLA. The purpose of this cross-sectional study is to report the prevalence of vestibular dysfunction in LLA and its impact on balance and falls.  
**Number of Subjects:** 65  
**Materials/Methods:** A convenience sample of healthy individuals with lower limb amputation (LLA) were recruited at the Amputee Coalition National Conference. Participants provided information on balance confidence (Activities-specific balance confidence scale) and history of falls (> 1 fall in the past 12 months). Subjects performed bipedal balance with eyes closed for 30 seconds with a wearable sensor attached to their sacrum. The maximal sway area (cm²) was used to assess balance performance. The video head impulse test (vHIT) was administered with the EyeSeeCam Goggle system (Interacoustics, Denmark); vestibular dysfunction was defined by having a vestibulo-ocular reflex (VOR) gain less than 0.8. Statistical analysis was performed using SPSS. Mann-Whitney U tests were performed to determine if there was a difference in balance performance based on vestibular dysfunction. Chi-square and the Fisher exact test were utilized to determine if the frequency of demographic characteristics were different between groups.  
**Results:** Sixty-five people with LLA participated in the study; 36 with transtibial (TTA) and 29 with transfemoral (TFA) amputation level. The mean age of participants was 48.7 ±14.2 years (range 19 -75). Twenty-three percent (n=15) subjects had vestibular dysfunction. There was no difference in ABC score (p=0.69) or eyes closed balance sway area (p=0.67) in LLA with vestibular dysfunction. While 30 subjects (46.2%) reported having one or more falls in the past 12 months, there was no difference in the distribution of positive fall history based on vestibular dysfunction ($X^2=2.97$, p=0.586). There was a significant difference in distribution of DM between groups ($X^2=6.21$, p=0.025), where subjects with DM had 5.8 greater odds of having vestibular dysfunction.  
**Conclusions:** There was a high rate (23%) of subclinical vestibular dysfunction in active LLA. However, there was no difference in balance confidence, balance performance, or fall history based on vestibular dysfunction.  
**Clinical Relevance:** This study presents evidence supporting the theory of subclinical vestibular neuropathy associated with DM in LLA. Based on this emerging evidence clinicians must consider the vestibular system when addressing balance and mobility limitations in LLA.
Purpose/Hypothesis: Following stroke, widespread changes in cortical network activity patterns occur in both lesioned and nonlesioned hemispheres [1,2]. Atypical interhemispheric (IH) interactions have been observed in stroke survivors with poor recovery and may be maladaptive for post-stroke recovery [3,4]. It is now possible to directly assess IH cortico-cortical interactions using electroencephalography (EEG) during transcranial magnetic stimulation (TMS) [5,6]. We have shown that IH interactions following TMS delivery were abnormal in chronic stroke during an active motor state and associated with post-stroke motor dysfunction [6]. However, TMS is not available in most clinical settings limiting the current translational potential of these findings. In the present study, we evaluated post-stroke EEG coherence prior to TMS delivery. The purposes of this study were to (1) compare the magnitude of IH connectivity in stroke survivors vs. neurologically-intact older adults during an active motor state, and (2) investigate the relationship between IH connectivity and paretic arm motor behavior.

Number of Subjects: Participants with chronic stroke-related arm impairment (n=20) and no history of stroke (n=14).

Materials/Methods: Participants completed the Upper Extremity portion of the Fugl-Meyer (FMUE) and grip strength assessments. Motor cortex (M1) excitability off the paretic (P) and nonparetic (NP) abductor pollicis brevis (APB) were determined with TMS. EEG was recorded during the delivery of 50 suprathreshold TMS pulses during a submaximal contraction of the APB ipsilateral to the site of TMS to index transcallosal inhibition. IH connectivity was calculated as the pre-TMS (-1000-0ms) imaginary part of EEG coherency (IPC) value between electrodes overlying M1 (C3, C4) within the beta frequency range (15-30Hz) [7]. We compared IPC in stroke vs. control groups during P vs. non-dominant and NP vs. dominant APB activation. Relationships between IPC vs. FMUE score and P grip strength were evaluated.

Results: In the stroke group, IPC was greater during P APB activation (p<.01) compared to controls. IPC was greater during P vs. NP APB activation in the stroke group (p=.04). IPC values were negatively correlated UEFM (r=-0.66, p<.01) and P grip strength (r=-0.49, p=.02) during NP, but not P, APB activation.

Conclusions: IH connectivity was abnormal in the stroke group and more abnormal IH connectivity during NP muscle activation was associated with poorer post-stroke motor behavior. Characterizing connectivity strength during NP muscle activation may index salient measures of adaptive corticomotor changes following stroke, potentially offering valuable insights into mechanisms influencing functional recovery.

Clinical Relevance: The current findings provide the first evidence that functionally relevant measures of IH connectivity can be measured during motor activity using brief EEG recordings in stroke survivors. Future studies can determine the clinical utility of EEG to index post-stroke IH connectivity to predict and evaluate therapeutic response.
TITLE: Improved Mobility in a Patient with ALS following a Strengthening and Conditioning Program: A Case Report

AUTHORS/INSTITUTIONS: M.J. Caraher, Department of Physical Therapy, University of Miami, Miami, Florida, UNITED STATES|L.P. Cahalin, M. Wong, Physical Therapy, University of Miami, Coral Gables, Florida, UNITED STATES|C. Vitolo, Department of Physical Therapy, University of Miami, Miami, Florida, UNITED STATES

ABSTRACT BODY:

Background & Purpose: Amyotrophic Lateral Sclerosis (ALS) is a progressive neurodegenerative disease that affects motor neurons in both the central and peripheral nervous system. Individuals with ALS have a variety of symptoms and over time lose the ability to initiate and maintain voluntary movement that is associated with severe fatigue, and poor recovery after strenuous activity. As a result, physical therapy (PT) management traditionally focuses on stretching and low intensity cardiovascular exercise. However, there is preliminary evidence that patients with ALS may benefit from moderate intensity resistance training (MIRT) when provided adequate recovery time. The purpose of this case report is to describe the response of a patient with ALS to MIRT.

Case Description: The patient was a 62 year old male with a diagnosis of ALS for 7 years who sought PT after his home exercise program (HEP) of chair level yoga and pranayama breathing had plateaued after 2 years. Based on acceptable pulmonary function test [forced vital capacity (FVC) was 88% of age predicted normal value], he was prescribed 16 sessions of MIRT, twice a week for 2 months. Biweekly sessions alternated their focus with the first focusing on upper body MIRT and the second focusing on lower body MIRT, via weight training and body-weight exercises, respectively.

Outcomes: After the 16 sessions, the patient demonstrated increased dorsiflexion (10 degrees) and increased strength (manual muscle testing revealed all muscle groups tested to increase by a minimum of ½ a grade, with full grade increase in bilateral lower extremity hip flexion and knee extension). The Function in Sitting Test (FIST) and the AM-PAC “6-clicks” were used to assess overall functional mobility. The patient demonstrated a 10 point increase in the FIST score and a 3 point increase on the Boston AM-PAC. Additionally, the distance ambulated improved from 5 ft at baseline to 60 ft at discharge with less fatigue. The FVC remained stable throughout treatment at 87% of age predicted normal value.

Discussion: This case highlights the potential benefits of MIRT for patients with ALS with improvements in strength, endurance, mobility, ambulation, as well as maintenance of pulmonary function. Due to the progressive nature of ALS, it is surprising that the patients pulmonary function was so well maintained which may have been due in part to his HEP of chair level yoga and pranayama breathing. As ALS progresses a patient’s FVC would predictably decline, and additionally would increase risk of mortality. Nonetheless, the patient’s history of pranayama breathing exercises prior to PT may have provided him with well maintained and robust respiratory muscle performance. Furthermore, since the respiratory muscles are also integral for postural control, his preserved respiratory muscle function likely elicited optimal benefit from the MIRT program. Further investigation of MIRT in patients with ALS appears warranted.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): 1. Ferriera G, Costa ACC, Plentz RDM, Coronel CC, Sbruzzi G. Respiratory training improved ventilatory function and respiratory muscle strength in patients with multiple sclerosis and lateral amyotrophic sclerosis: systematic review and meta-analysis. J. Physio 2016.01.002


TITLE: Corticospinal Drive to the Plantarflexors Predicts Capacity for Walking Function Post-stroke

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ABSTRACT BODY:

Purpose/Hypothesis: While the presence of responders and non-responders among rehabilitation candidates is recognized, intrinsic physiologic characteristics of these groups of individuals remain unclear. Among prominent gait deficits following stroke, ankle plantarflexion (PF) is critical to producing forward propulsion, momentum, and limb advancement. Here we tested the hypothesis that gait function following stroke is associated with corticospinal efficacy to the plantarflexors.

Number of Subjects: We studied 34 adults: (13 healthy controls, mean age 61.7 (±8.5) yrs, 7 male); 21 stroke survivors, mean: age (64.9 (±8.9) yrs, chronicity 82 (±58) months LE FMA 25.8 (±7.2), 18 male).

Materials/Methods: We used transcranial magnetic stimulation (TMS) to measure motor evoked responses (MEPs) during isometric and dynamic ankle PF contractions. Participants were seated, positioned with the knee at 20-30 deg flexion and ankle at 0 deg PF. Single-pulse TMS was delivered over the ipsilesional (target) hemisphere using a custom Fig-8 coil (70mm diameter/wing) at 120% of resting motor threshold to assess corticomotor excitability and modulation during dynamic effort. Stimulation location was determined by online evaluation of MEPs to maximize responses in the paretic (target) leg PFs (SOL, MG). Neuronavigation (BrainSight2) was used to track and maintain coil location. Participants generated PF torque between 10-20% of maximum voluntary contraction for 1s which triggered stimulations when the ankle was held at (isometric), or moving through (dynamic), neutral. Ankle PF power (A2), derived from inverse dynamics using data obtained separately during instrumented gait analysis, served as our primary measure of gait function. SOL, MG, and tibialis anterior (TA) MEPs were manually identified and ensemble averaged (~10 repetitions per condition). MEP area was normalized to background EMG.

Results: Stepwise regression using K-fold cross-validation (5 iterations) identified parameters predicting A2 magnitude in both stroke (.54011 +.0312 MG-dynamic -.0031 Chronicity, R2 = .675) and Control (2.48 -.007 MG dynamic, R2 = .21) groups. MG MEP area during dynamic PF was significantly correlated with A2 (R = .463, p = .008).

Conclusions: Confirming our hypothesis, cortical drive to the PFs during active movement predicts walking function. In this sample, additional predictive value is contributed by chronicity following stroke.

Clinical Relevance: Our results illustrate the importance of intrinsic neurobiological function to neuromechanical capacity. Individual differences, or heterogeneity, in both function and capacity are recognized among stroke survivors. A priori identification of responders and non-responders could substantively improve the efficacy and efficiency of rehabilitation by informing the development of interventions appropriately targeted towards: i) individuals with the capacity for recovery, ii) the most significant impairments, and iii) neural and biomechanical mechanisms with the potential for plasticity.
Purpose: Physical therapy (PT) is often hampered by lack of access to therapists and lack of adherence to home therapy regimens. In 2015 UCSD was awarded a National Science Foundation grant (6) to fund a project using sensor technology and machine learning. The project aim is to provide real-time feedback to make home sessions as effective as office visits with an expert therapist. In developing our system, we selected the Parkinsons Disease population based on evidence that unsupervised home exercise is the least effective way to deliver treatment to this population (1). In addition to higher rates of depression, apathy, musculoskeletal problems, and mild cognitive impairments, Parkinson patients also demonstrate impaired sensorimotor integration and altered axial kinesthesia. Due to these impairments they require increased external feedback for carryover of exercise training (3).

Description: We used patients currently undergoing outpatient PT to participate in the project. Based on their scores on the 5xSTS and mini BEST, the patients were assigned a variation of 3 set exercises. These exercises were selected based on principles from the sensorimotor Agility Boot Camp exercise program (2) and each exercise having 4 task variations to allow for adapting the exercise. We used the Kinect color depth camera to measure angles and motion features of the patients (5). Criterion and thresholds were set for the computer that matched the clinician’s recommendations to perform quality movements and to achieve the task successfully. Based on the therapist’s assessment and the computer analysis, the patient was either progressed, maintained, or regressed for the next performance of the task. This information helps the computer learn what an expert clinician looks for when analyzing patient’s movements.

Summary of Use: With ongoing collaboration between our engineering and PT departments, our hope is to develop computerized technology that can analyze patient movements, provide real-time feedback, and progress exercises appropriately without the patient having to be present in the clinic or direct supervision from a PT. The technology would allow the patient to attend 1-2 sessions for instruction in the initial exercises, with subsequent progression of exercise performed at home. The treating therapist will have access to patient data collected by the Kinect system in order to monitor patient progress and adjust the plan of care as needed. This would allow for higher exercise intensities which is proven to be more beneficial in the Parkinson population (4).

Importance to Members: Use of sensor technology to replicate clinic PT has a multitude of benefits to both the patient and the clinician. Patients frequently travel long distances to receive specialized treatment at a center of excellence for Movement Disorders. This technology could allow increased patient access to specialized care, decreased cost of treatment, and increased compliance and accuracy with performance of home exercise programs.


ABSTRACT BODY:

Purpose/Hypothesis: Nerve transfers, or neurotization are an emerging surgical intervention used to increase function in patients with spinal cord injury (SCI) who present with lower motor neuron (LMN) damage. Nerve transfers may lead to improved function if end organs are reinnervated by transferred nerves. This systematic review aimed to assess the degree of functional sensorimotor recovery following nerve transfers in persons with SCI.

Number of Subjects: N/A

Materials/Methods: Literature searches were performed using Ovid, Pubmed, Google Scholar, and Scopus. The terms searched were: spinal cord injury, trauma, spinal cord, spinal cord transection, nerve transfers, nerve crossovers, neurotization, nerve graft, motor function, strength, range of motion. For this systematic review, studies were included if they addressed sensorimotor function that could impact quality of life (QOL). Articles were included if they were published within 10 years or less and were in English. Articles were excluded if they contained other therapeutic interventions in addition to a nerve transfer, such as functional electronic stimulation. Articles were selected based on a two-step process: first by title and then by abstract content. Finally, the remaining full text articles were assessed for study quality using the checklist developed by Downs and Black.

Results: In total, 293 articles were found after removing duplicates from the total search results. After eliminating articles by title, 86 articles remained. After reviewing the articles abstracts 16 articles were identified for full text review and 11 met the studies inclusion/exclusion criteria. Six studies looked at function of the upper extremity, three at bladder, one at sensory and one at respiration function.

Conclusions: Most research on nerve transfers in the SCI population is based on level IV and V evidence. However, outcomes show that nerve transfers may be effective for patients with SCI by ameliorating specific functional limitations. The studies focused on a variety of body structures for functional outcomes, which included arm movement, finger and thumb flexion, bladder control and respiration. Further research involving higher quality designs and quantity of patients should be conducted to produce replicable functional outcomes associated with neurotization.

Clinical Relevance: By restoring a degree of function to end organs denervated by LMNs, nerve transfers can lead to an improvement in patients with SCI’s QOL. While functional outcomes from the surgery may increase physiological reinnervation, rehabilitation would be a keystone in the recovery of functional use of the reinnervated structure. Therefore, this will lead to an increased role of physical therapy for post-surgical patients.
Purpose/Hypothesis: The purpose of the study was to explore the impact of the LSVT BIG program provided within a small group environment on the motor and non-motor symptoms of Parkinson’s disease.

Number of Subjects: 14

Materials/Methods: This study was performed over the course of one calendar year spanning from February 2016-February 2017, executing the protocol over the course of four 6-week trials. In order to be eligible, participants had to be 18 years or older with a diagnosis of Parkinson’s Disease. Data collection occurred during the week prior to starting the program and the week after it had finished. Participants were required to complete the LSVT BIG Assessment packet, the Unified Parkinson’s Disease Rating Scale (UPDRS), the PROMIS questionnaire; the patient reported outcomes form, and the patient satisfaction form. This allowed researchers to gather general patient information and information on the stage of their Parkinson’s disease, the severity of their symptoms, motor impairments, and their emotional and psychological states. Researchers utilized the following physical performance measures: 6 Minute Walk Test (6MWT), Timed Up and Go (TUG) (under 3 conditions including manual and cognitive components), Five Times Sit to Stand (5STS), and the Turn Test. Participants completed the dynamic gait index (DGI), Timed Up and Go (TUG) under 3 conditions, Turn Test, and 6 MWT while being videotaped for live scoring and later analysis of the video to verify and validate the scoring. This research poster includes results from TUG, TUG- Manual (TUG-M), TUG-cognitive (TUG-C), 6MWT, and DGI. The UPDRS, PROMIS, 5STS, and Turn Test scores are still being aggregated and verified.

Results: On average, participants required > 14.7 seconds (14.95 s) to complete TUG cognitive prior to completing LSVT BIG program, indicating increased risk of falls. Following LSVT BIG program, participants required an average of 13.67 seconds to complete TUG cognitive, indicating decreased risk of falls. Using a paired t-test for pre-test and post-tests, TUG cognitive scores were statistically significant (p=.028). Neither TUG nor TUG-M scores reached statistical significance, p=.099 and p=1.57, respectively. The mean change between 6MWT pre- and post-intervention distances was 126.793 ft, and the mean change in DGI score decreased by .667 points. Paired t-tests were run on 6MWT scores were statistically significant (p=.019).

Conclusions: This study provides some support to the efficacy of the LSVT BIG protocol to reduce fall risk and improve functional mobility in individuals with Parkinson’s disease.

Clinical Relevance: Providing LSVT BIG in a small group setting could be an effective strategy for providing physical therapy. The LSVT BIG protocol calls for 1:1 participant to certified practitioner, which was provided within the small group. The group allowed for the participants to support and push each other during the intensive protocol. Further analysis of the non-motor measures and the additional motor performance measures are needed as well as comparison to a control group.
Background & Purpose: Modifications to footwear and specialty shoes are commonly prescribed for orthopedic populations, mostly for pain management, but also to increase speed and step length. Rocker soles increase speed and step length in persons with stroke and in healthy conditions. Preliminary research shows benefit in persons with spinal cord injury using a rocker sole with a reciprocating gait orthosis, but there is no evidence of shoewear modification as an adjunct to ankle and foot orthotics (AFO). The purpose of this case study is to identify if modifications to shoewear in persons with spinal cord injury will decrease gait deviations and increase walking speed and endurance.

Case Description: Two individuals with incomplete, non-traumatic chronic spinal cord injury, classified as T10 AIS D (client A) and C2 AIS D (client B) were treated in outpatient physical therapy. Client A was 25 months post injury and presented with a right, articulating ankle and foot orthotic with a double action ankle joint. Client B was 13 months post injury and presented with bilateral, articulating ankle and foot orthotics with double action ankle joints. Shoe modifications including rocker soles, wedging, lateral buttress, toe rocker, and shoe lift were made to their shoes. Outcome measures included observational gait analysis (OGA), 10 meter walk (10MWT), and six minute walk test (6MWT).

Outcomes: Client A’s gait speed slowed on the 10MWT from 0.74m/s to 0.69m/s. She walked less distance on the 6MWT from 316 meters to 287.6 meters after shoewear modifications. Client B’s gait speed improved, progressing from 0.86m/s to 0.94m/s after shoewear modifications. These improvements did not reach the MCID for persons with SCI. Client B improved from 339m to 344m on the 6MWT but this did not reach the MCD of 50 meters for this test. The OGA indicated client A had decreased contralateral vaulting, intact heel and toe rockers, and decreased circumduction in swing phase. Client B demonstrated improved heel and toe rockers, increased knee flexion in pre and initial swing phase, and decreased lateral trunk sway in midstance with his gait. According to the OGA both clients had fewer major gait deviations.

Discussion: This case study suggests that shoe modifications can improve gait deviations, as measured by the OGA. Improved gait mechanics can decrease abnormal stresses on the joints and lead to improved stability and forward progression with walking. When considering shoe modifications for persons with SCI those changes may not clinically or statistically improve their objective outcome measures. This case study suggests that clients respond differently to shoe modifications in conjunction with ankle and foot orthotics and require individualized approach and consideration.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
GNE Myopathy: Recognizing Key Features to Optimize Physical Therapy Treatment in a Rare Myopathy

J.M. De Simone, Adult Outpatient Neurological Physical Therapy, NYU Langone Medical Center, Rusk Rehabilitation, Bronx, New York, UNITED STATES

ABSTRACT BODY:

Background & Purpose: GNE myopathy, a rare autosomal recessive adult-onset disorder with progressive muscle atrophy and weakness, is due to a missing GNE/MNK enzyme. Progressive distal limb weakness with a unique quadriceps sparing presentation is common. Investigational drug trials exist, but the disease currently has no cure. GNE myopathy has often been misdiagnosed, due to large exclusions in the population when histopathologic diagnostic criteria required multiple findings on muscle biopsy. Today the diagnosis relies heavily on clinical presentation, including muscle imaging, and is confirmed by genetic studies. GNE myopathy presents with unique patterns of muscle dominance—quadriceps vs hamstrings, abductors vs adductors, hip extensors vs hip flexors, plantar flexors vs dorsiflexors, triceps vs biceps. Subjective reports of tripping, difficulty managing steps and rising from chairs are the most common initial complaints. The authors have partook in data collection for a GNE myopathy IRB approved drug trial for 4 years, and are now seeing this population in the clinic. There is no literature available on GNE myopathy and physical therapy at this time. This report will identify the clinical characteristics of this rare myopathy and highlight the role of physical therapy (PT) in improving physical function, decreasing falls risk, and improving quality of life in this patient (pt) population

Case Description: Pt is a 42 year old female, with a 6 year progressive decline in distal bilateral lower extremity weakness with increased falls. She was referred to PT for strengthening, balance, gait training, and transition from soft over the counter AFOs to custom AFOs. She was not enrolled in a drug trial. On evaluation, pt with impaired strength, balance, endurance, and increased fear of falls. Pt received 30-60 min individual PT sessions 1-2 times per week for 32 sessions. Treatment emphasized strengthening dominant muscle groups to optimize function (extensors vs flexors), balance training (anticipatory and reactionary), and progressing high level mobility (plyometrics and slip/trip training) with appropriate AFOs.

Outcomes: First to final outcome measures: 5 Time Sit to Stand 9 sec to 6 sec, Timed Up and Go 7.8 sec to 6.6 sec, Gait Speed (GS) self-selected 1.21 m/s to 1.49 m/s, GS fast 1.56 m/s to 1.79 m/s, Mini-BESTest 20/28 to 27/28, and Hi-MAT 27/54 to 29/54. Fall rate from x1 weekly to x1 in 3 months.

Discussion: Knowledge of GNE myopathy presentation and prognosis enabled PT to develop targeted strengthening programs to improve functional strength, decrease risk of falls, and improve quality of life. Focused strengthening of dominant muscles in moderate intensity to prevent fatigue is essential in a population with difficulty generating new muscle fibers. Education on appropriate bracing to decrease falls risk and improve high level mobility added to pt quality of life. More research is warranted for pts with the rare diagnosis of GNE myopathy and further potential therapeutic gains should be considered as results from drug trials emerge.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward): Argos Z. GNE myopathy: a personal trip from bedside observation to therapeutic trials. Eur J Hum Genet. 2016 Feb;24(2):243-51. doi: 10.1038/ejhg.2015.78. Epub 2015 May


Purpose/Hypothesis: The Activities-specific Balance Confidence (ABC) Scale is a commonly used, self-administered measure which was developed to evaluate the level of confidence individuals have in their balance when performing 16 common daily activities. It is used extensively to help determine if individuals are at increased risk for falls. Individuals self-rate their confidence that they will not lose their balance for each item on a 0-100% scale. Physical therapists who work with patients that live in urban areas are frequently told that some items on the ABC are not applicable to their daily lives. The purpose of the study is to evaluate the relevance of each item on the ABC to individuals living in urban environments in order to determine which items, if any, have low relevance to these individuals.

Number of Subjects: 30

Materials/Methods: Thirty subjects were recruited from patients presenting to the New York Eye and Ear Infirmary for an initial physical therapy evaluation in the vestibular rehabilitation department. All subjects were English speaking, over the age of 18, resided within the five boroughs of New York City, and were able to complete a survey without assistance. Subjects were asked to rate the relevance of each item to their daily lives on a scale from 0-10 and to write in three additional activities for which they have low balance confidence that were not asked on the ABC.

Results: Four items were identified as having low relevance to subjects living in urban settings—“...walk across the parking lot to the mall”; “...walk outside the house to a car parked in the driveway”; “...walk in a crowded mall where people walk rapidly past you”; and “...bumped into by people as you walk through the mall”. The most common additional activities for which they have low balance confidence were outdoor activities reflective of extrinsic fall risk factors, including crossing busy streets and riding public transportation.

Conclusions: The findings are consistent with the hypothesis that some items on the ABC are not relevant to individuals living in urban environments. We identified 4 items with low relevance.

Clinical Relevance: The ABC is frequently used to help assess fall risk across many populations, but some of the items on the questionnaire do not pertain to the daily lives of individuals in urban settings. Individuals may not be able to rate their balance confidence accurately if they do not perform these activities. There may be a need to either modify or add an additional subset of questions to the ABC in order to encompass activities that individuals in urban settings do perform that may be unique to this environment.
TITLE: Effect of Gaze Stability Exercises on Chronic Motion Sensitivity: A Randomized Controlled Trial

AUTHORS/INSTITUTIONS: E. Johnson, T.C. Nelson, O.I. Ambode, A.A. Albalwi, A.A. Alharbi, N.S. Daher, Physical Therapy, Loma Linda University, Loma Linda, California, UNITED STATES|S.B. Gaikwad, Physical Therapy, Nova Southeastern University, Fort Lauderdale, Florida, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: Motion sensitivity is a common condition among the general population and may cause postural instability and anxiety. The purpose of this study was to investigate the effect of progressive gaze stability exercises on postural stability, motion sensitivity and anxiety in healthy young adults with chronic motion sensitivity.

Number of Subjects: 41

Materials/Methods: A single-blind randomized controlled trial was conducted. Forty-one participants of both genders ages 20 to 40 years with chronic motion sensitivity were randomly assigned to two groups. Intervention group performed gaze stability exercises while sham group performed saccadic eye movement exercises for 6-weeks. Bertec Balance Advantage-Dynamic Computerized Dynamic Posturography with Immersion Virtual Reality (CDP-IVR), Motion Sensitivity Quotient (MSQ), Motion Sensitivity Susceptibility Questionnaire Short Form (MSSQ-Short), and State-Trait Anxiety Inventory for Adults (STAI Form Y-2) were the outcome measures used.

Results: A significant difference in mean CDP-IVR score of condition 2 was identified between the two groups (P = 0.05), however, there was no significant interaction between time (Pre vs. Post) and group. For condition 2, the intervention group demonstrated a 117% increase in mean CDP-IVR score compared to 35.2% increase in the sham group. MSQ reduced significantly from baseline to post six-weeks in the intervention group (4.0±1.2 vs. 1.9±0.9, P = 0.004). However, there was no significant change in mean STAI score in the intervention group (36.4±2.7 vs. 35.7±2.3, P = 0.81). In addition, a significant inverse correlation between MSQ and mean CDP-IVR equilibrium % of C1 (ρ = -0.44, P = 0.004) was identified indicating that the subjective perception of motion sensitivity was inversely correlated to postural stability.

Conclusions: Progressive gaze stability exercises reduced motion sensitivity and improved postural stability but had no effect on anxiety in participants with chronic motion sensitivity. Also, perception of motion sensitivity was inversely correlated with postural stability.

Clinical Relevance: Healthy young adults commonly experience motion sensitivity during various daily life and recreational activities. Pharmacological interventions are known to control symptoms for a temporary period while exposing the individual to side effects of medication. Instead, a simple daily dosage of 10-minutes of gaze stability exercises that can be performed at home may help to reduce motion sensitivity and improve postural stability in this population for an extended period.
TITLE: The effect of fatigue on motor performance in persons with Parkinson’s disease: Partial results of an ongoing study

AUTHORS/INSTITUTIONS: H. Karpatkin, D. Schroeder, E. Polster, E. Gayeski, L. Meredith, P. Sheer, Physical therapy, Hunter College, City University of New York, New York, New York, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Fatigue is a well-documented complaint of persons with Parkinson’s disease (pwPD), but its effects on mobility tasks such as balance have not been examined. Fatigue in other neurologic conditions such as MS have been shown to have a significant impact on gait and balance. The purpose of this study is to investigate whether fatigue has an impact on mobility in persons with pwPD. We hypothesized that when pwPD experience fatigue, their performance on mobility tasks will be worse than when unfatigued. If our hypothesis is correct, it will suggest that clinicians who treat pwPD will need to consider the effects of fatigue on mobility tasks, and should perform mobility testing in both fatigued and unfatigued conditions when assessing pwPD.

Number of Subjects: Subjects have been recruited from local PD exercise groups and from the Michael J. Fox Foundation. To date, 14 subjects (9 males, 5 females, [Age=64.6 +/- 10.4, Hoehn and Yahr =2.4 +/- .76]) have completed the study. Impact of fatigue, as measured by the Parkinson’s Disease Fatigue Scale was 40.9, +/- 15.1, and overall disease impact as measured by the Parkinson’s Disease Questionnaire (PDQ-39) was 35.0, +/- 16.7, indicating mild to moderate self reported fatigue and disease severity.

Materials/Methods: A randomized crossover repeated measures design was used. Data collection started in September of 2016 and will continue through December of 2017. Following obtaining demographic and subject characteristics, subjects were randomized into either a fatigued (F) or unfatigued (U) condition. All subjects then performed the mini BESTest (MBT). Subjects in the (F) condition then performed a 6-minute walk test to induce fatigue, immediately followed by another MBT. Subjects in the (U) condition would perform the MBT, sit for 6 minutes, then perform the MBT again. One week later, subjects would return and repeat the test, performing whatever condition they did not perform the first time.

Results: A 2 (pre vs. post) X 2 (fatigued vs. unfatigued) repeated-measures ANOVA was performed to examine the difference between conditions. A significant decrease from pre-test (M=20.9, SD=2.9) to post-test (M=19.0, SD=4.0) was found in the MBT scores in the fatigued condition (F(1, 13) = 12.008, p=.004). MBT scores in the unfatigued condition did not change significantly from pretest (M=20.7, SD=3.1) to posttest (M=21.0, SD=3.9), (F(1, 13)=2.244, p=XXX). A significant interaction effect was found (F=11.038 (1,13), p=.006).

Conclusions: In this ongoing study we found that pwPD performed more poorly on balance testing when fatigued than when unfatigued. This suggests that fatigue, a common finding in pwPD may in part explain some of the mobility deficits that are noted in pwPD.

Clinical Relevance: Clinicians who work with pwPD should consider testing their patients in a fatigued as well as an unfatigued condition to determine if their falls risk is worsened by fatigue. Given the prevalence of fatigue in PD, testing pwPD in an unfatigued condition may result in an inaccurate assessment of their true mobility issues.
**Title**: A Tool to Quantify the Impact of Oscillopsia on Functional Mobility  

**Authors/Institutions**: T. Kiemel, University of Maryland, Laurel, Maryland, UNITED STATES | J. Jeka, Kinesiology, University of Delaware, Newark, Delaware, UNITED STATES | E.R. Anson, J. Carey, Otolaryngology, Johns Hopkins School of Medicine, Baltimore, Maryland, UNITED STATES  

**Abstract Body:**  

**Purpose/Hypothesis**: Individuals with vestibular hypofunction (VH) often report symptoms of oscillopsia during walking. Existing assessments of oscillopsia are limited to descriptions of severity and symptom frequency, neither of which provides a description of functional limitations or activity changes attributed to oscillopsia. A novel questionnaire, the Oscillopsia Functional Impact scale (OFI) was developed to describe the impact of oscillopsia on activity participation and mobility. Questions on the OFI ask how often individuals are able to participate in specific activities considered to depend on gaze stability in an effort to link functional mobility impairments to oscillopsia for individuals with vestibular loss.  

**Number of Subjects**: 14 individuals with bilateral VH, 6 individuals with unilateral VH, and 29 healthy controls participated in this study.  

**Materials/Methods**: Subjective reports of oscillopsia severity on a visual analogue scale (oVAS), oscillopsia frequency (OSQ), dizziness handicap inventory, and balance confidence (ABC scale) were recorded for each subject. Spearman correlation coefficients were calculated to determine the relationship between the OFI and other questionnaires that characterize oscillopsia severity/frequency, dizziness, and balance perception to demonstrate face validity. Chronbach’s alpha was calculated to demonstrate internal validity for the OFI. A one way MANOVA was conducted with planned post-hoc paired T-tests to determine group differences on all oscillopsia questionnaires.  

**Results**: The OFI was highly correlated with measures of oscillopsia severity ($r = .84$) and frequency ($r = .88$) and also with the Dizziness Handicap Inventory ($r = .89$) and the Activities Specific Balance Confidence scale ($r = -.85$). Chronbach’s alpha for the OFI was 0.97. Individuals with unilateral VH and bilateral VH scored worse on all measures of oscillopsia and dizziness handicap compared to healthy individuals ($p’s < .05$).  

**Conclusions**: The OFI appears to capture the construct of oscillopsia in the context of functional mobility. Combining with oscillopsia metrics that quantify severity and frequency allows for a more complete characterization of the impact of oscillopsia on an individual’s daily behavior. The OFI discriminated individuals with either bilateral VH or unilateral VH from healthy individuals.  

**Clinical Relevance**: Adding the OFI to the battery of subjective rating scales for individuals with BVH allows more complete characterization of the impact that oscillopsia has on functional behavior and activity participation. Previous questionnaires were not adequate to capture the impact of oscillopsia on this aspect of the ICF model.
TITLE: Does Sand-Assisted Locomotor Training Improve Gait Symmetry?

AUTHORS/INSTITUTIONS: D. Hoke, R. Aponte, J. Dolley, L. Simari, S. Kim, School of Physical Therapy & Rehabilitation Sciences, University of South Florida, Tampa, Florida, UNITED STATES| I. Handzic, TAO Life Sciences, Tampa, Florida, UNITED STATES| K. Reed, Department of Mechanical Engineering, University of South Florida, Tampa, Florida, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: Split-belt treadmill training has been utilized for the recovery of gait symmetry after stroke. However, due to the high cost of a split-belt treadmill, a more cost efficient gait training approach is needed. Locomotor training on sand may be a possible low-cost alternative intervention to improve gait symmetry. The purpose of this study was to investigate whether sand-assisted locomotor training (SALT) could modify gait symmetry in healthy young individuals.

Number of Subjects: 7

Materials/Methods: Seven subjects were randomly assigned into either the SALT group (23±3 years old, n=3) or the control group (23±3 years old, n=4). Each group underwent a 30-minute gait training, walking on a sand walkway (SALT group) or an over-ground walkway (control group). Subjects’ spatiotemporal variables (i.e., step length and swing phase of gait cycle) during their comfortable walking were assessed before and after training, and then after 5 minutes of over-ground walking using the ProtoKinetics Zeno Walkway System.

Results: Changes in step length and swing phase symmetry were 1.7% and 1.4%, respectively, in the SALT group and 0.4% and 0.9%, respectively, in the control group following training. The modifications were retained to a certain extent after 5 minutes of over-ground walking.

Conclusions: The SALT group showed relatively greater changes in gait symmetry after training compared to the control group. In particular, the change in step length symmetry was evident in the SALT group.

Clinical Relevance: Locomotor training on sand could be used as a cost efficient therapeutic approach to regain symmetrical walking following stroke.
TITLE: Lateral Step Treadmill Training for Paretic Limb Step Initiation in Chronic Stroke Survivors


ABSTRACT BODY:

Purpose/Hypothesis: To investigate the effectiveness of reactive lateral step treadmill training (RLSTT) on balance control in community dwelling stroke survivors (SS). SS have an impaired ability to initiate a reactive step with their paretic limb which increases their fall risk. Task-specific induced-step training may improve the ability to initiate reactive stepping with the paretic limb. We hypothesized that following RLSTT, SS would demonstrate an increased frequency of initiating reactive stepping with the paretic limb (PL) during RLSTT and in response to waist pulls and a reduced Four Square Step Test (FSST) time.

Number of Subjects: Three community-dwelling subjects (S10, S12, S14) completed this study. Ages: 46, 73, and 44 years; months post onset: 77, 84, and 40; lower extremity STREAM scores: 16/20, 10/20, and 14/20, respectively.

Materials/Methods: SS performed 6 RLSTT sessions (80 trials each) over 3 weeks. SS were instructed to stand sideways on treadmill with PL toward the front and equal weight on both legs in a standardized position. SS were instructed to step with PL first and maintain stepping within a set boundary without use of external support. The treadmill was turned on at random times for 3 seconds at 0.7 mph. A successful trial consisted of the SS demonstrating an initial PL step while staying within the set boundary and requiring no external assist. The boundary was narrowed by 17.5% after 10 consecutive successful trials. SS were simultaneously engaged in a word-guessing game. Pre and post-tests included: a 40 trial RLSTT treadmill assessment, 5 trials of reactive lateral stepping in response to laterally directed waist pulls, and the Four Square Step Test (FSST).

Results: All subjects completed all 6 training sessions. S10 and S14’s training boundaries were narrowed over the 6 sessions to 73% and 85% respectively. All subjects initiated PL stepping more often in the post-treadmill assessment (55-72%). During reactive waist pulls to the non-paretic side, the frequency of NPL lateral steps increased (40-93%), PL medial steps decreased (27-0%) and PL crossover steps decreased (33-7%) from pre to post-test. For reactive waist pulls to the paretic side, the frequency of NPL crossover steps decreased (80%-25%), PL lateral steps increased (20-28%) and NPL medial steps (0-47%) increased from pre to post testing. S10 and S14’s FSST times decreased by 14%.

Conclusions: RLSTT improves initiation of stepping with both the PL and NPL. RLSTT decreased the incidence of cross over steps, which have been observed to contribute to foot collisions during reactive stepping in older adults. The fact that the participants increased PL stepping in response to treadmill movement more than in response to waist pull perturbations may indicate a specificity of training effect. Improvement in FSST time may indicate a positive effect of RLSTT on voluntary step speed.

Clinical Relevance: RLSTT provides a challenging, clinically feasible option for reactive lateral step training for SS. Ideally, reactive training should include varied perturbation types and directions.
A Case Report of Lateral Step Treadmill Training in Chronic Stroke

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Background & Purpose: Community-dwelling stroke survivors (SS) have a high fall risk and this is considered to be one of the most prevalent post-stroke complications. SS step preferentially with the non-paretic limb (NPL), in part due to the paretic limb’s (PL) impaired ability to initiate a reactive step. There are not many clinically feasible ways to train reactive stepping. The purpose of this case study was to describe a SS’s response to 6 sessions of reactive lateral step treadmill training (RLSTT).

Case Description: A 73 year-old male, 84 months post-stroke with right hemiparesis, a PL STREAM score of 10/20, and a score of 44.38% on the Activities-Specific Balance Confidence Scale was recruited for 6 sessions of RLSTT over 16 days. For training, he was instructed to stand with equal weight bearing with his feet perpendicular to belt movement with PL nearest the front. The treadmill was turned on for 3 seconds at 0.7 mph. He was instructed to initiate a lateral step with his PL in response to treadmill movement and to step as quickly as possible to stay within a set boundary for the 3 second trial. Participant was simultaneously engaged in word guessing game. Each RLSST session included 80 trials.

Outcomes: Pre and post-test treadmill assessments consisted of 40 trials of RLSTT. The number of trials in which stepping was initiated with PL, trials requiring assist and trials where he was able to stay within the set boundary were recorded. At the end of the sessions, the participant was asked to rate his perception of how challenging the RLSTT was on a 0 – 10 scale (0= not challenging at all; 10=extremely challenging). Over the first 4 training sessions, the participant demonstrated a gradual increase in the trials where he initiated stepping with PL from 22.5% to 70%. He also demonstrated a gradual decline in number of trials requiring external assist from 26.25% to 11.25%. He increased the percentage of trials in which he was able stay within the boundary from 3.8% to 46.30%. He then plateaued in all parameters over remaining 2 training sessions. His ratings of perceived challenge decreased from 9/10 to 6/10 from the pre-test to the first training session. The ratings fluxuated between 6/10 and 7/10 during the first 4 sessions, dropping to 5/10 in the 6th session and the post-test.

Discussion: RLSTT may be a clinically feasible option to train PL lateral reactive stepping. The need for less external assist and increased ability to stay within the training boundary indicate that this participant was able to initiate and execute quicker lateral steps with both limbs. Although he required assistance for all sessions he was willing to persist with training despite the perceived level of challenge remaining relatively stable after the pre-test. He may have reached a plateau after 4 sessions because he reached his peak capacity for reacting to this type of perturbation although he may have improved more had the training continued longer than 6 session.

TITLE:  Impact of a Community-based Rock Steady Boxing Program for People with Parkinson’s Disease: A Pilot Study.

AUTHORS/INSTITUTIONS:  K.L. Johnson, Program in Physical Therapy, University of North Dakota, Grand Forks, North Dakota, UNITED STATES|

ABSTRACT BODY:
Purpose/Hypothesis :  High-intensity physical exercise has been shown to be beneficial in managing motor and non-motor symptoms of Parkinson’s disease (PD). Exercise may also have global effects on factors that influence brain health and cognition. Programs that incorporate goal-based motor skill learning have shown promise in being more effective than aerobic exercise alone. People with PD have a need for ongoing, continuous, community-based exercise programs that are engaging and accessible. The purpose of this study was to examine the effect of a community-based exercise program, Rock Steady Boxing, on improving quality of life and physical mobility skills in people with PD.

Number of Subjects :  10

Materials/Methods :  Ten participants, 5 females and 5 males, mean age 69.6 years old (± 12 SD), clinically diagnosed with PD with a mean disease duration of 12.1 years (± 10 years) were recruited. Physical Therapist and Physical Therapy students collaborated with a local YMCA to offer a Rock Steady boxing program (non-contact) to promote mobility, high intensity exercise, cognitive engagement and transitional movements. Pre and Post assessment at 3 months included gait speed, PDQ-39 for quality of life change, Mini BESTest to measure balance/mobility, Five Times Sit to Stand to measure strength, Four Square Step Test (FSST) for agility, and the Six Minute Walk Test to measure endurance.

Results :  Five of the 10 participants reported an improvement in overall PDQ-39 scores. Of the 10 participants, 30% showed minimally clinically important change in cognition (MCID -1.8) and mobility (MCID -3.2), and 20% reported improvement in bodily discomfort (MCID -2.1). Post-test results of other measures were not statistically significant. Eight of the 10 participants attended the class, with a mean attendance of 7.7 visits (range 0-15), and indicated a plan to continue the exercise class. Statements from participants included: “more confidence with balance”, “more energy”, and “enjoy the social aspect”. Three of the 10 also reported a reduction in falls, and one reported an increase in falls during the 3-month timeframe.

Conclusions :  The outcomes of this pilot study show promise in improving quality of life and mobility in older adults with PD. Despite the progressive nature of PD, 30-50% of the participants in this study reported meaningful change in quality of life subscales while attending a 3-month exercise program. More research is warranted to determine longer-term benefits.

Clinical Relevance :  Community-based exercise programs tailored to people with PD appear beneficial in improving functional mobility and quality of life. Programs that incorporate a combination of high intensity exercise, skill-based training, cognitive engagement and social interaction are recommended. People with PD will benefit from consistent attendance at classes that are designed to be both physically and financially accessible, to minimize barriers and encourage long-term exercise participation.
TITLE: The effects of heat and cold immersion on performance measures during the Wingate Anaerobic Test

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ABSTRACT BODY:

Purpose/Hypothesis: It is known that hot or cold temperature immersion (HCTI) can affect human physiology, and both are commonly used in rehabilitation settings. However, the way these modalities affect exercise performance is poorly understood. In particular, there is limited research regarding the effects of HCTI on performance when these modalities are administered prior to exercise. Thus, the purpose of this study was to explore the effects of these modalities upon performance during high intensity cycling.

Number of Subjects: Thirty women (23.00±2.67 yr, 165.77±5.95 cm, 61.97±10.56 kg) completed this study. Criteria was used to 1) include subjects who exercise at least 30 minutes 3 or more days per week and 2) exclude individuals a) who possess any type of pathology which would, by itself, alter gross motor coordination, or b) who regularly cycle.

Materials/Methods: Using a counterbalanced design, participants visited the laboratory on three occasions and completed the Wingate Anaerobic Test (WAnT) following three immersion protocols: HOT, COLD, and no immersion or control (CON). Following each of these standardized warm-up conditions, subjects rode an electronically-braked cycle ergometer at maximal intensity for 30 seconds. Conditions were controlled and measured by computer. The following variables were assessed during each trial: speed, watts, cadence, and measures of cycling efficiency (SpinScanTM, and average torque angle (ATA) throughout the 360° of pedal travel). A repeated measures ANOVA was used for statistical analysis.

Results: Significant differences were found between conditions for cycling speed (F(2,28)=4.947, p≤0.014) and power output (F(2,28)=4.947, p≤ 0.014) during the WAnT. Post-hoc analyses with Bonferroni correction indicate that both cycling speed (p≤ 0.011) and power output (p ≤ 0.011) were significantly different between HOT and COLD conditions. No post-hoc differences were found between the HOT or COLD and CON conditions. No other assessed dependent variables were significantly different between conditions. Yet each of these dependent variables assessed in this study were significantly different over the 5 second increments commonly assessed during the WAnT. There were no significant interactions found for condition and time.

Conclusions: The findings support previous reports that type of immersion can influence physiology. The present findings support the notion that heat immersion may improve some forms of human performance, as well as support previous studies showing that cold immersion may reduce performance in high intensity activities immediately following.

Clinical Relevance: Given the few studies on the effects of HCTI prior to maximal exercise, these results have both scientific and clinical value, supporting previous studies suggesting that heat application tends to stimulate human physiological performance. The present findings may assist clinicians in making better use of HCTI routines in rehabilitation programs.
TITLE: Task-dependent changes in contralesional motor cortical excitability after stroke

AUTHORS/INSTITUTIONS: S.S. Kantak, Physical Therapy, Arcadia University, Glenside, Pennsylvania, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: There is an growing debate about the role of contralesional motor cortex in recovery of motor function after stroke. While different models of post-stroke brain reorganization postulate different roles for the contralesional motor cortex, the role of task dexterity in determining the engagement of contralesional motor cortex is unknown. The purpose of the study was to determine the effects of task dexterity on corticospinal excitability and inhibitory-facilitatory mechanisms of the contralesional motor cortex in patients with chronic stroke.

Number of Subjects: 12 patients with unilateral stroke (6 right-brain damaged and 6 left-brain damaged) participated in the study.

Materials/Methods: Participants with unilateral hemiparesis performed no task (rest), a gross-motor task and a fine-motor task with the paretic hand while transcranial magnetic stimulation was applied over the contralesional motor cortex. Gross-motor task consisted of transporting light-weight plastic balls over a fixed distance using a spherical grasp. In contrast fine-motor task consisted of transporting Purdue pegs over the same fixed distance. Motor evoked potentials (MEP) were measured from first dorsal interosseus and extensor carpi radialis of the resting nonparetic arm by stimulating the contralesional motor cortex at suprathreshold stimulation intensity in an event-locked manner. Short-interval cortical inhibition (SICI) and intracortical facilitation (ICF) were measured by determining the effects of a subthreshold conditioning stimulus on the MEP response of a suprathreshold stimulus at an interstimulus interval of 3ms and 12 ms respectively.

Results: Compared to rest, there was an increased excitability (i.e. larger MEPs) in contralesional FDI and ECR during both the gross-motor and fine-motor tasks. Motor cortical excitability of the FDI was significantly higher during the fine-motor task compared to the gross motor task. In contrast, motor cortical excitability of ECR did not show task-dependent modulation. SICI was significantly reduced in FDI and ECR during the fine-motor task compared to the gross-motor task. There were no changes in the ICF across task conditions.

Conclusions: Task dexterity led to muscle-specific changes in the excitability of the contralesional motor cortex, suggesting a greater excitability and potentially greater engagement of the contralesional motor cortex projecting to the FDI muscle during fine-motor tasks that require dexterity. The greater excitability was accompanied by lesser amount of inhibition within the intracortical circuits of the motor cortex. Thus the role of contralesional motor cortex is modulated by dexterity requirements of the task performed by the paretic arm.

Clinical Relevance: In addition to lesion characteristics, non-invasive brain stimulation protocols used to augment motor performance of the paretic arm must take in to consideration the dexterity requirements of the task.
**Title:** Functional outcomes of a patient post-stroke with LVAD following intensive inpatient rehabilitation: A case study

**Authors/Institutions:** B.K. Smith, Physical Therapy, University of Florida, Gainesville, Florida, United States; R. Studer-Byrnes, Physical Therapy, University of Florida, Gainesville, Florida, United States; C.L. McGovern, University of Miami, Miami, Florida, United States

**Abstract Body:**

**Background & Purpose:** As the rate of heart failure continues to rise, placement of Left Ventricular Assist Devices (LVAD) has increased as a bridge to transplant and as destination therapy. Following placement of LVAD, patients are at increased risk for stroke. Current evidence supports intensive post-LVAD rehabilitation, but a structured, tolerated exercise prescription is less understood in patients post-LVAD placement with subsequent stroke.

**Case Description:** The patient was a 66-year old male admitted for inpatient rehab following an extended acute care hospital stay post-LVAD placement and acute cerebellar stroke. He presented with ataxia, decreased postural control, and upper and lower extremity weaknesses that limited ambulation ability to moderate assistance of two for short distances and rendered him dependent to complete all activities of daily living. The patient underwent a progressively dosed strengthening and postural control program, alternating daily between upper and lower extremity exercises and exercises emphasizing postural control optimizing challenge. Endurance was addressed daily via increases in either ambulation distance or time. The patient completed open chain exercises for both the upper and lower extremities beginning with AAROM against gravity for large muscle groups, and reached 2-3 pounds by discharge. Postural control exercises emphasized closed chain and challenge and began in supine progressing to standing with full weight bearing without upper extremity support. Exertion was monitored using the modified rate of perceived exertion scale (mRPE). Patient therapy sessions progressed from 30-60 minutes with reduction in rest breaks between sessions from 3 to 2 hours.

**Outcomes:** Baseline evaluations included the six-minute walk test (6 MWT), Berg Balance System (BBS), and Functional Independent Measure (FIM) scores. Exercise sessions were dosed at mRPE<6-7/10 and rest breaks were modified as endurance improved. After 29 days of rehab with therapy sessions 6-7 days per week for 3-4 hours per day, outcomes on discharge indicated meaningful change on the FIM from 44 to 80 out of 126, which was also supported by meaningful changes on both the BBS and 6 MWT. Detailed analysis of this data will be further presented in the poster.

**Discussion:** This study highlights improvements made in functional outcome, ambulation, and balance measures while in inpatient rehab. A patient post-LVAD and cerebellar stroke made meaningful changes following implementation of a progressively dosed strengthening, cardiovascular, and postural program. Current research is insufficient to guide a physical therapist’s ability to optimize appropriate intensity to reach age-matched normed outcomes given perceived medical instability due to the complexity of LVAD placement coupled with subsequent stroke. Further evidence is needed on the appropriate dosage and tolerated exertion for the LVAD population with subsequent stroke.

**References:** Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):

4. Nguyen, E, Stein, J; Functional Outcomes of Adults with Left Ventricular Assist Devices Receiving Inpatient Rehabilitation. PM R 2013;5:99-103
TITLE: Respiratory criteria to determine readiness to wean from diaphragm pacing in patients with cervical spinal cord injuries


ABSTRACT BODY:

Background & Purpose: Intramuscular stimulation of the diaphragm (i.e. diaphragm pacing) is now used in acute cases of spinal cord injury (SCI) to promote weaning from mechanical ventilation (MV). Recent evidence indicates that nearly one third of patients who require diaphragm pacing (DP) may recover independent breathing such that DP is discontinued and the intramuscular pacing wires are removed. Criteria to initiate weaning from DP has not been reported and there is limited evidence regarding strategies to wean from pacing and promote independent respiration. However, criteria to determine readiness to wean from MV are well-established and therefore may be useful to gauge readiness to initiate weaning from DP. The purpose of this case series is to describe three SCI patient cases in which individuals weaned from DP and to compare respiratory outcomes to established predictors of weaning from MV.

Case Description: Respiratory outcomes from three individuals with cervical SCIs were reviewed. The individuals were selected from participants in an ongoing study of DP because they had weaned from DP and recovered independent respiration. The three cases included one male (60 y.o., C2, AIS B) and two females (27 y.o., C4, AIS B; 29 y.o., C4, AIS C). Standard respiratory outcomes had been obtained at regular intervals during independent respiration (i.e. with the stimulation unit turned off) following American Thoracic Society Guidelines. Outcomes obtained within the 3 days prior to initiation of weaning from DP were compared to established predictors for weaning from MV. The following respiratory outcome predictors were compared: tidal volume, forced vital capacity, maximal inspiratory pressure generation, and the rapid shallow breathing index.

Outcomes: Overall, respiratory outcomes at the time of weaning from DP for the 3 patients exceeded the criterion levels established for 3 of the 4 MV weaning predictors. Specifically, tidal volumes exceeded prediction criterion (>5ml/kg) by an average of 13% and maximal inspiratory pressure generation exceeded the criterion (<-30 cmH2O) by 54%. All patients surpassed the rapid shallow breathing index criterion (<65 breaths/min/L). In 2 cases, forced vital capacity volumes were less than 10% below prediction criteria levels (>15ml/kg). In the 3rd case, the patient's forced vital capacity was 50% below the criterion for ventilation weaning.

Discussion: In 3 cases of successful weaning from DP, the patients far surpassed criteria for maximal inspiratory pressure generation and the rapid shallow breathing index. This may suggest that these threshold levels are less useful for determining weaning from DP. However, in these 3 cases, tidal volumes and forced vital capacity outcomes were more consistent with threshold levels established for MV weaning. This suggests that these measures may be useful for determining readiness to wean from DP. Establishment of criteria for successful weaning from DP is necessary to promote recovery of independent respiration in patients with cervical SCI.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
1. Posluszny, Joseph A. et al, Multicenter review of diaphragm pacing in spinal cord injury: Successful not only in weaning from ventilators but also in bridging to independent respiration; Trauma Acute Care Surg: February 2014- Volume 76, Number 2, 303-305.
Background & Purpose: To date, the bulk of research on dual task performance has concerned gait, and how it is impacted by the addition of secondary tasks. In contrast, dual task interference on upper extremity function is a relatively untapped area of research, with few existing studies completed to date, and even fewer completed evaluating the performance of older adults. However, upper extremity function is crucial to accomplish a wide range of daily tasks, all of which are routinely paired with secondary tasks. A developed understanding of the dual task paradigm as applied to upper extremity function can drive interventions, predict age or condition related decline, and tailor treatments creatively in response to observed deficits. Lastly, it is crucial to have an understanding of normal upper extremity function in older adults under dual task conditions to serve as a point of reference when treating patients with corresponding deficits.

Case Description: Studies including generally healthy adults 50 years of age and older wherein the performance of an upper extremity task was paired with an secondary task, with the upper extremity task being evaluated both singly and under dual task conditions. Across the six studies, a total 167 individuals participated, with average ages ranging from 66 to 83 years old. The majority of the upper extremity tasks measured were easily translated into functional activities: transferring a coin from one pocket to another, writing on a clipboard, following a target with a finger, carrying a tray, and gripping an object between the forefinger and thumb.

Outcomes: In general, the addition of a secondary task resulted in diminished performance of the primary upper extremity task. However, performance varied widely, with the outcomes being impacted by skill transfer and the patient's confidence, visual acuity, and ability to prioritize.

Discussion: Generally speaking, practice of a single task did not translate well to a dual task, and even with practice, the dual task was not performed as skillfully as under single task conditions. This suggests that patients need to be challenged under a variety of conditions, as their skill level in one setting may not translate smoothly to another. This could involve engaging with the patient verbally or changing their environment during therapy. Tasks that required a higher level of visual acuity resulted in greater competition for the older adult's attention (who tend to use their vision more than proprioception or visual awareness). This suggests that visual demand should be considered when planning therapeutic tasks for older adults. Lastly, adults with a fear of falling were not able to prioritize their attention to the dual task, regardless of coaching, while adults with no fear of falling could be challenged to improve their function. This suggests that attentional prioritization can be coached in therapy in certain situations to the patient's benefit.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):
Purpose/Hypothesis: Patient education regarding disease management is an important element of an inpatient rehabilitation stay. Along with preparing patients for increased functional independence, therapists also seek to provide patients and caregivers with improved disease knowledge. While the importance of patient education is apparent, rehabilitation teams lack objective methods to monitor patients' education retention regarding their disease. The purpose of this study is to utilize diagnosis-specific assessments to quantify improvements in disease knowledge and to determine factors that may influence patient education retention.

Number of Subjects: 45

Materials/Methods: This study utilized a retrospective chart review of patients admitted to a county hospital inpatient rehabilitation unit who received a diagnosis-specific assessment called the Patient Education Retention Assessment, or PERA. Six PERA tools were previously developed with a policy and procedure improvement project for improved patient education. Each PERA included up to 19 questions regarding basic disease management and prevention of secondary complications. Forty-five patients with admission and discharge PERA scores for their admission diagnosis were analyzed. Statistical analysis was performed to determine improvements in PERA scores and to establish the strength of relationships between PERA scores and various demographic and rehabilitation factors.

Results: The results of this study demonstrated low admission PERA scores across the four diagnostic groups included in statistical analysis: amputation, stroke, diabetes, and spinal cord injury. Wilcoxon-signed rank tests revealed that each diagnostic group demonstrated statistically significant improvements in PERA scores between admission and discharge. Demographic factors, including age, gender, and language, did not influence PERA scores per regression analysis. Two rehabilitation factors, length of stay and use of speech-language services, were found to influence education retention according to PERA performance.

Conclusions: Patients included in this study's cohort demonstrated a low disease knowledge rate upon admission per PERA scores. Each diagnostic group demonstrated some improvement in disease knowledge during their inpatient stay. Potential factors affecting education retention included length of stay and need for speech-language services. Future studies are required to establish reliability, validity, and cut off scores for each PERA tool, as well as to expand the sample size and to balance diagnostic groups for improved analysis of potential factors.

Clinical Relevance: This study demonstrates that length of stay and need for speech-language services may affect a patient's ability to retain disease-specific education provided to them during an inpatient rehabilitation stay. The assessment tool utilized in this study introduces a method of assessing education retention and will require further research to become an established outcome measure.
TITLE: Clinical Correlates of Diffused Traumatic Brain Injury during Functional Recovery

AUTHORS/INSTITUTIONS: D. Gobert, Physical Therapy, Texas State University, San Marcos, Texas, UNITED STATES

ABSTRACT BODY:

Purpose/Hypothesis: We proposed to characterize post-concussion symptoms in persons with diffused traumatic brain injury (dTBI) using standardized clinical assessment tools including a computerized neurocognitive assessment in combination with an automated functional eye movement assessment (FEMA) using eye tracking technology.

Number of Subjects: 26 volunteers (12 females/14 males) age 18 years and over with a history of dTBI were recruited for this study.

Materials/Methods: Participants received two test sessions 3 weeks apart including: a physical screen with visual acuity, computerized test and convergence eye test, the computerized neurocognitive testing and an automated functional eye movement assessment using laser eye tracking technology. Eye track recorded data were analyzed offline using an automated computer program to identify saccadic, fixation and glissadic oculomotor behaviors. A reference database (Controls) including 298 participants without head injury from a previous study was used for comparisons. Variables of interest were: Visual Acuity LogMAR score, Perception Time, Near Point Test convergence score, Visual Memory score, Verbal Memory score, Visual Motor score, Cognitive Reaction Time, Vertical Saccade Speed, Saccade Rate and Fixation Drift Velocity.

Data Analysis: Data analysis included descriptive statistics using SPSS to describe test outcomes. Variable comparison analyses included a MANOVA for outcome differentials using Gender and Number of Concussions as fixed factors and the Spearman Rho Correlation Coefficient analysis to test relationships between response variables. Alpha levels were set at p<0.05.

Results: Participant average age was 23.15 (+/- 3.77) years with 1 to 5 head injuries each with 68% with an average onset of injury 31.52 (+/- 27.02) weeks. Average previous night's sleep was 7.44 (+/- 1.28) hours. Average NPT convergence score was 7.61 (+/-4.93) cm. Vision scores for PERCEP = 38.40 (+/-10.28) msec. Cognitive scores were: VeMEM = 57.74 (+/-31.92) %, ViMEM = 59.35 (+/-26.76) %, VMOT = 56.67 (+/-28.20) %, CRT = 48.46 (+/-25.36) %, TSYMP = 21.04 (+/-20.41). FEMA scores were: SR = -0.39 (+/-1.02) saccades/sec, VSS = -0.53 (+/-1.33) m/sec, FDV = 0.09 (+/-1.15) m/sec. There was a significant positive relationship between NPT and TSYMP (r=0.427, p=0.033), VeMEM and ViMEM (r = 0.425, p = 0.030), PERCEP and VeMEM (r = 0.445, p = 0.026), VSS and ViMOT (r = 0.555, p= 0.021). FDV was significantly related to both VSS (r = -0.500, p = 0.041) and SR (r = 0.498, p = 0.042). There was a significant difference in SR = -0.61 (+/-1.16) compared to Controls (-0.02 +/- 0.993, p = 0.001) saccades/sec and FDV (0.46 +/- 0.70) compared to those without dTBI (0.053 +/- 0.99, p= 0.019) m/sec.

Conclusions: Our results indicate that there is a significant relationship between functional eye movement and prolonged symptoms after diffused traumatic brain injury.

Clinical Relevance: We propose that functional eye movement testing in combination with neurocognitive testing is crucial to document treatment response and long term symptom recovery.
TITLE: The Use of a Wearable Sensory Prosthesis to Improve Gait and Balance in a Patient with Peripheral Neuropathy

AUTHORS/INSTITUTIONS: D. Wrisley, G. McLean, Wingate University, Wingate, North Carolina, UNITED STATES|L. Oddsson, Rx Functions, Minneapolis, Minnesota, UNITED STATES

ABSTRACT BODY:

Background & Purpose: People with peripheral neuropathy have altered use of somato-sensation for balance and are at increased risk of falls. Walkasins is a Wearable Sensory Prosthesis that can replace the impaired sensation and improve gait and balance. The Walkasins provides magnitude and direction of sway by detecting the pressure distribution under the feet and sending the signals to an array of vibratory tactors that ring the lower leg. The purpose of this case report is to describe the influence of the Walkasins on balance and gait for an individual with diabetic peripheral neuropathy.

Case Description: A fifty-one year old male with a multiple year history of type II diabetes and a 3 year history of peripheral neuropathy was fitted with the Walkasins and wore them 8-10 hours/day for 4 months. He also participated in gait and balance training twice weekly. His vibration sense was absent at the 1st MTP joint but intact at the lateral malleolus. His tactile thresholds were >50 g in the lower extremity up to the tibial tuberosity bilaterally.

Outcomes: His initial scores were as follows: Activities-specific Balance Confidence Scale (ABC) 32.5%; Mean Vestibular Activities of Daily Living Scale (VADL) 3.54; Mini-Balance Evaluation Systems Test (mini-BEST) 15/28; Functional Gait Assessment (FGA) 13/30; and gait speed 0.23 m/sec. The scores increased to the following within 1 month of initiating use of the Walkasins (tested while wearing the device): ABC 73.75; VADL 2.29; mini-BEST 26/28; FGA 28/30; and gait speed 1.01 m/sec. The patient described decreased pain, cramping, use of pain medication and increased function and ADLs.

Discussion: Clinical gait and balance measures improved with the use of the Walkasins. This suggests that a Wearable Sensory Prosthesis used daily may ameliorate symptoms from peripheral neuropathy and help improve gait and balance function. Further research is needed to determine if other patients will have a similar response and the amount of sensory function necessary to use the Walkasins.

Purpose: Salience has been recognized as important in augmenting neuroplasticity and recovery post-stroke. Limited information is established regarding how to identify salient activities for patient treatment, and how an intervention based primarily on patient-selected salient activities may impact patient outcomes. This preliminary report demonstrates the impact of focusing on patient-selected salient activities in a novel intensive day camp and the impact on psychosocial and mobility outcomes of individuals with chronic stroke.

Description: Five individuals with chronic stroke participated in a ten-day long "Stroke Camp" (6 hours of therapy per day). On day one, participants completed the Canadian Occupational Performance Measure (COPM). The COPM identifies daily activities they “want to do, need to do, or are expected to do,” but that they “can’t do, don’t do, or aren’t satisfied with how they do.” Traditional PT-based measures were also collected, including: gait speed, cadence, step length, 6 Minute Walk Test (6MWT), Timed Up and Go (TUG), and the Stroke Specific Quality of Life Scale (SSQoL).

Interventions were administered by a team of PT/OT staff and students focusing on participants’ self-selected salient activities, with emphasis on use of affected extremities. All outcome measures were repeated at the end of “Stroke Camp” (10 days), and at a 3-month follow-up. Four participants were available for follow-up assessment.

Summary of Use: From pre- to post-"Stroke Camp," 5/5 participants had clinically significant improvements in self-reported satisfaction and performance with activities identified on the COPM. These improvements were maintained for 2/4 participants at follow-up, and remained above baseline values for 4/4 participants. SSQoL ratings improved for 4/5 participants, and further improved for 3/4 participants at follow-up. Self-selected and fast walking speed improvements occurred in 5/5 participants, with concurrent increase in cadence and step length. Walking speed improvements were maintained for 1/4 participants. 6MWT distance and TUG time also improved for 5/5 participants, and further improved for 2/4 participants at follow-up.

Importance to Members: The COPM can be used to objectively identify salient patient-specific activities for guiding physical therapy interventions. Interventions driven by patient-selected activities also resulted in participants improving in traditional physical therapy outcome measures. The sustained increase of COPM performance and satisfaction scores above baseline values at follow-up may have contributed to the continued improvements in the SSQoL. A longer intervention time period with additional practice may be required in order for lasting mobility changes to occur. The identification and addressing of salient occupational-based goals can be a valuable tool for use in physical therapy practice.
TITLE: The effects of hip flexion orthotic vs dynamic ankle foot orthotic on walking ability in patients with Multiple Sclerosis: A Case Series

AUTHORS/INSTITUTIONS: T.H. Lee, Physical Therapy, Honorhealth, Scottsdale, Arizona, UNITED STATES | A. Pinner, HonorHealth, Scottsdale, Arizona, UNITED STATES

ABSTRACT BODY:

Background & Purpose: People with Multiple Sclerosis (MS) demonstrate gait impairments due to a variety of factors including leg weakness, spasticity, and impaired sensation. The dynamic AFO is commonly prescribed to address gait impairments and can improve foot clearance and walking speed in people with neurologic dysfunction. However, the dynamic AFO may not improve foot clearance when a primary limitation is hip flexor weakness. The purpose of this study was to compare a less prescribed hip flexion assist orthosis to a dynamic AFO to improve ability to walk in individuals with MS.

Case Description: Two patients with MS were referred to an outpatient physical therapy clinic with chief complaints of difficulty walking, multiple falls, and impaired balance. Both individuals presented with hypertonicity of leg muscles determined by Modified Ashworth Scale, weakness of the hip, knee, and ankle musculature noted by manual muscle testing, and decreased walking ability noted by 2 and 6 minute walk tests. In addition to strength, balance, and endurance exercises, multiple orthotic devices were trialed to determine which maximized their ability to walk.

Outcomes: On the two minute walk test, patient one walked 326 ft with 37 toe drags and minimal assistance using the dynamic AFO and improved to 345 ft with only 6 toe drags and contact guard assistance using the hip flexion orthotic within same session. On the six minute walk test, patient two walked 482 ft without AFO and mod assist, 600 ft with AFO and min A, and 720 ft with hip flexion assist orthosis and contact guard assist. Three years later when the disease had progressed patient two was no longer able to walk with or without AFO, though was able to walk 390 ft using the hip flexion orthotic and front wheeled walker.

Discussion: Walking speed, gait mechanics, and independence with walking all improved with use of the hip flexion orthotic compared to use of no orthotic or toe off AFO. The outcomes of this case series suggests that the hip flexion orthotic may be a beneficial tool to improve walking for patients with hip flexor weakness that do not show improved gait mechanics with standard AFOs. The two patients in this case series were not reaching the needed 25 degrees of hip flexion during swing phase due to hip flexor weakness, which caused impaired clearance of the foot during swing phase. With the hip flexion orthotic, weakness of the hip flexors was compensated for and the hip flexion angle was achieved. Unfortunately this hip flexion orthotic may be underutilized within the neurological population and patients are being prescribed standard AFOs which do not have as much benefit on gait mechanics in people with significant hip flexion weakness. More research is needed to determine the effectiveness of a hip flexion orthotic in the neurological population.

References: Limit to only those materials that ensure that the content is evidence-based; minimum 5 references, no more than 10 years old (2008 and forward):


Wening J, Ford JJouett LD. Orthotics and FES for maintenance of walking in patients with MS. Disease A Month. Aug; 59, 2013, 284-289
Background & Purpose: Post-Concussion Syndrome (PCS) is a disorder related to signs and symptoms that last for a prolonged time (>10 days to months) after the incident. The PCS population often complains of persistent dizziness and imbalance well after sustaining the injury. Evidence indicates that vestibular and balance dysfunction exist in many PCS cases and vestibular rehabilitation (VR) can be beneficial in addressing a prolonged recovery. However, the literature is sparse in outcomes for the PCS population suffering from vestibular and balance issues after a prolonged time. The purpose of this case report is to examine changes in self-reported, performance based, and sensory organization outcome measures of a patient with chronic PCS to a customized VR program.

Case Description: The patient was an 18-year-old Hispanic female who sought VR for dizziness and balance dysfunction associated with diagnoses of PCS. She sustained two non-sport related concussions within two weeks of each other. Initial evaluation was performed 86 days following injury. She presented with a 68% impairment in perception of handicap as measured with the Dizziness Handicap Inventory (DHI) self-report measure, Post-Concussion Symptom Checklist (PCSC) reflected a 41% impairment with moderate to severe symptoms including (headache, imbalance, dizziness, fatigue, and difficulty with concentration and memory), Romberg Test was positive, the Modified Clinical Test of Sensory Organization (mCTSIB) presented with loss of balance in condition (2) and (4), while trying to use somatosensory and vestibular input to maintain postural control, and Functional Gait Assessment (FGA) score was a 21 out of 30. The patient completed 23 treatment sessions of 60 minutes, each consisting of gaze stability and substitution exercises, habituation exercises (Brandt-Daroff, gait with head turns, and VOR cancellation in diagonal patterns), and balance training with emphasis on multisensory strategies.

Outcomes: After 23 VR sessions, all measures improved, the DHI score (68% to 12% impairment), PCSC (from 41% to 2% impairment), negative Romberg Test, mCTSIB with ability to maintain postural control in conditions (2) and (4) with no loss of balance for 30 seconds, and FGA score improved (21 out of 30, to 25 out of 30) reflecting improved balance for gait.

Discussion: This case report describes improvement in perceived dizziness, PCSC, sensory organization, and FGA following a customized VR program to facilitate vestibular compensation and adaptation in a patient with PCS. Consideration should be taken to design a customized VR program for the chronic PCS population that is tailored to specific impairments and functional limitations related to vestibular and balance function. Recovery from chronic PCS can be a long and slow process but appropriate vestibular and balance exercises can assist in achieving optimal outcomes and improved quality of life.

Purpose/Hypothesis: Cerebrovascular accident (CVA), or stroke, is a common cause of disability in the U.S. with more than half of individuals experiencing hemiparesis and motor control deficits. Motor control is one of the most important outcomes for clinical rehabilitation. Currently, there are no objective measures for motor control that have been validated in the research. This pilot study attempted to validate the use of an accelerometer smartphone app, 2D video app, and a Boyd and Graham scale, which was modified for application to elbow flexion and knee extension, including specific compensatory muscles.

Number of Subjects: Seven participants with a history of a stroke were recruited to perform voluntary isolated joint movements at the elbow and knee.

Materials/Methods: Elbow flexion and knee extension movements were captured with the Hudl Technique App (HTA) and the Sensor Kinetics Pro App (accelerometer), comparing affected and unaffected sides to identify the onset of decreased motor control within the arc of motion. The HTA allowed the angle of lost motor control to be recorded, and the Composite Amplitude Index (CAI) was computed from the accelerometer. The accelerometer data was analyzed, comparing affected to unaffected side CAI scores, and comparing accelerometer to HTA and Modified Boyd and Graham Scale (MGBS), as rated by two researchers.

Results: MBGS scores were significantly correlated with the accelerometer CAI scores for the elbow (r=.954) for both novice and experienced examiners, but no such findings were observed for the knee. A significant inverse correlation (r=-.967) was found between the knee CAI scores of the accelerometer and examiner scores for the experienced examiner only. There was an observable change between the early (smoother) tracing compared to the later impaired portion of the accelerometer tracing.

Conclusions: This study indicates feasibility of using accelerometer technology and the MBGS to document motor control impairment in individuals with neurologic impairment. Small sample size and some patients with bilateral involvement are limitations of the study. Accuracy of accelerometer comparisons could be improved by analysis of the specific window of accelerometer data during impaired control rather than the entire movement.

Clinical Relevance: The smartphone accelerometer could be a valuable clinical tool for objective and precise measure of motor control impairment, to encourage a patient in their motor recovery, to document improvement for third-party payers, and to improve interrater reliability over current subjective measures.
Purpose: Huntington’s disease is a fatal genetic disorder characterized with a complex set of motor, neuropsychological, and psychiatric symptoms deteriorates an individual with Huntington’s Disease (IWHD) functional performance over time. The nature of HD requires a specialized professional medical team providing coordinated multidisciplinary care throughout the spectrum of the disease process. Unfortunately, current healthcare delivery models present severe limitations in providing easily accessible, patient-centered, coordinated comprehensive care to IWHD. Comprehensive clinics serving IWHD would alter this outlook and improve their accessibility to care. Physical Therapists (PTs) are a valuable component of this comprehensive medical team serving to improve the function and quality of life for IWHD.

Description: An ideal comprehensive medical team is led by the neurologist with input from rehabilitation services, nursing, neuropsychiatry, social services, dietitian, chaplain services, and genetic counseling. Without highly coordinated, competent and accessible care, IWHD experience psychological distress and poor quality of life, as well as gaps in health care and social support services. PTs serve IWHD from diagnosis to the end stages of palliative care. Within the early to mid-stages, PTs assist with planning and sequencing of activities of daily living, provide interventions to improve apraxia and impaired motor planning, and improve the mobility and fall risk of IWHD. In the middle stages, PTs provide care addressing the secondary adaptive changes and deconditioning, abnormal posturing and worsening chorea and dystonia. In the late to end stages PTs serve to maintain respiratory dysfunction, assist in care-partner training and ADLs, and help obtain durable medical equipment to maximize function.

Summary of Use: IWHD within the comprehensive clinic would be seen periodically throughout their disease course. Often newly diagnosed individuals are seen every 2 months, then progress to every 4, 6, or 12 months depending on their level of severity. Modifications are made to this plan if there is a higher amount of unmet needs. PTs provide extensive evaluation and skilled PT intervention addressing their motor, cognitive, and behavioral symptoms to IWHD and their care-partners.

Importance to Members: Currently, there is no curative treatment for individuals with HD (IWHD). Thus, to improve the quality of life for this IWHD, treatment must be aimed at alleviating cognitive, behavioral, and physical symptoms, improving or maintaining function. PTs play an important role in anticipating the disease process to optimize function of the IWHD through the course of the disease. Comprehensive care with allows IWHD to receive a variety of services resulting in an improved quality of life and decreased effects of caregiving. This model for comprehensive care of HD may shed some light on how to optimize the care for IWHD and their challenging and complex clinical presentation, especially when there is potential to moderate disease progression.
TITLE: Determining the Validity of the “4 Meter Walk Test” iOS Application in Measuring Comfortable and Fast Gait Speed

AUTHORS/INSTITUTIONS: D.W. Fell, S. Allen, J. Corley, H. Jeziorski, S. Whitted, Dept of Physical Therapy, University of South Alabama, Mobile, Alabama, UNITED STATES|J.C. Wall, Physical Therapy, University of South Alabama, Daphne, Alabama, UNITED STATES|

ABSTRACT BODY:

Purpose/Hypothesis: This study examined the validity of a smartphone application called the “4 Meter Walk Test” when measuring both comfortable and fast-but-safe gait speed. The smart phone application calculated walking speed and compared the result to the walking speed calculated using stopwatch data, which is considered the gold standard. If the application is considered valid, it would be a helpful tool for clinicians to utilize to calculate a patient’s walking speed and to determine their functional level.

Number of Subjects: 114 subjects were recruited from the University and local senior centers.

Materials/Methods: The 4 Meter Walk Test, developed by the NIH Toolbox as a measure of locomotion, was performed. Each subject performed 4 trials, 2 trials at self-selected comfortable speed and 2 trials at a fast but safe speed. Each trial was performed on a walking grid with thorough instruction per the NIH toolbox. One researcher was timing with the stopwatch and another was timing with the “4 Meter Walk Test” smartphone application. The mean difference between the results from the two devices were calculated and the 95% confidence interval was determined.

Results: The mean difference between the iOS application and the stopwatch for walking speed was found to be 0.01m/s for self-selected comfortable speed, and 0.04m/s for self-selected fast speed.

Conclusions: Given that the minimum detectable change for walking speed is 0.1 m/s, the difference is clinically insignificant and so the iOS application can be considered valid.

Clinical Relevance: The implications from this project is that the “4 Meter Walk Test” smartphone application would provide a quick and helpful tool that clinicians could utilize when evaluating patients walking speeds, both comfortable and fast but safe speeds. This will allow Physical Therapists to determine the functional level in a more efficient manner.
The Need for a Reliable and Validated Sitting Balance Measure in SCI

M.E. Klaeb, M. Jennings, M. Hatch, SCI Research, VA Long Beach Medical Center, Rancho Santa Margarita, California, UNITED STATES

Purpose: The purpose of this project is to analyze existing seated balance measures in the non-ambulatory SCI population as a primary step in developing a reliable, easy to use, clinical seated balance assessment for SCI.

Description:

Description: A literature review was conducted using the terms: ‘sitting balance,’ ‘seated balance,’ ‘unsupported sitting’ and ‘spinal cord injury’ in PubMed, with a filter for human studies. Relevant studies were selected based on the following criteria: 1) studies included non-ambulatory SCI patients, and 2) the primary purpose of the study was to assess seated balance. We excluded studies where balance assessment was only included as an outcome in an interventional study, and focused on those developing balance measure and/or those assessing validity or reliability of a seated balance measure. For this review, 10 studies met our criteria. These selected studies were then read by 2 licensed Physical Therapists who solely work with individuals with SCI, and a SCI rehabilitation researcher. Each paper was assessed by each rater based on a rubric developed by the team ahead of time.

Summary of Use: We found that existing studies on seated balance assessment were markedly varied in their approaches, making standard comparisons between studies difficult. However, 5 categories (types of tests) naturally emerged from the published studies: reaching tests, timed unsupported sitting, computer posturography/force plate analysis, t-shirt test/dressing, and other. In this review we provide a description of these categories, discuss validity or reliability testing (if and when performed), and provide limitations and/or advantages of these measures in regards to their practical use in the clinical rehabilitation setting. We also provide a discussion on a few new outcome tools recently developed for seated balance assessments in other neurological disorders and discuss the feasibility of adapting them for the SCI population. The aim of this literature review is to provide the information that will inspire a more reliable and clinically useful seated balance measure: whether it is the potential modification of an existing measure, or the development of an entirely new tool.

Importance to Members: Seated balance is extremely important for individuals with SCI as it impacts many aspects of their daily living such as wheelchair mobility, transfers, dressing/bathing and bladder and bowel maintenance. As such, balance control and maintenance is a heavy focus in this population’s rehabilitation. However, no reliable and valid measure for exist. It is our strong belief that Physical Therapists working with SCI individuals are in desperate need of a reliable, easy to use, clinical measure for seated balance assessment. Additionally, individuals with SCI will greatly benefit from enhanced assessments of seated balance, which could impact wheelchair prescription, assist devices, rehabilitation goals, and more.